ENVIRON

DESIGN OF A SITE PROTECTION AND MONITORING PROGRAMME FOR MORGANITE ELECTRICAL CARBON LTD

IPPC Permit VP3339PD

REQUIRING REFERENCE DATA TO BE COLLECTED

July 2005

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Summary

This document represents the design Site Protection and Monitoring Programme (SPMP) for:

Morganite Electrical Carbon Ltd
1 Upper Fforest Way
Morriston
Swansea
SA6 8PP

Permit number: VP3339PD

Morganite Electrical Carbon Limited submits this report to the Environment Agency (EA) in pursuance of Condition 4.1.7 of the Permit No. VP3339PD (the "Permit") authorising the operation of Morganite Electrical Carbon Limited (the "installation").

This design document is required by Condition 4.1.7 to be submitted to the Agency within 2 months of the date of issue of the Permit.

An intrusive investigation is required to be undertaken to characterise substances identified as being potentially present in, on or under the ground in the Application Site Report (ASR) submitted with the Permit Application. ***A considerable amount of investigative work has been completed at the site over the past several years, and it is therefore considered that sufficient information has already been gathered to provide suitable Reference Data.***

This document contains a summary of the scope of the most recent investigations completed at the site, and should be read in conjunction with the ASR for the installation which provides details of the environmental site setting and the previous investigative works undertaken.

The Environmental Monitoring Programme for the installation is presented in *Section 4* and *Appendices B to E*. The results of routine monitoring will be collated into a Monitoring Report and sent to the Agency by the 31st of January each year. The Monitoring Report will also contain any recommendations for changes to the Site Protection and Monitoring Programme, which will be incorporated into the SPMP subject to the agreement, in writing, of the Agency.

The testing, inspection and maintenance programme for pollution prevention infrastructure at the site (the Infrastructure Monitoring Programme) has been designed as detailed in *Section 4.4* and *Appendix E2*.

No industry sector guidance for operations undertaken at the facility was available at the time of application.

1.0 Introduction

This document represents the design Site Protection and Monitoring Programme (SPMP) for:

Morganite Electrical Carbon Ltd
1 Upper Fforest Way
Morriston
Swansea
SA6 8PP

Permit number: VP3339PD

Morganite Electrical Carbon Limited (MECL) submits this report to the Environment Agency (EA) in pursuance of Condition 4.1.7 of the Permit No. VP3339PD (the "Permit") authorising the operation of Morganite Electrical Carbon Limited (the "installation").

This report has been written by ENVIRON UK Limited on behalf of MECL. ENVIRON UK Limited reserve the right to use competent specialist third parties on MECL's behalf in order to fulfil the requirements set out in this document (i.e. service tracing companies, drilling contractors etc.). Where practicable these will be agreed at the time with the relevant Environment Agency contact.

1.1 Site Location

MECL occupies a site of 22 acres located to the North-East of Swansea, within the Lower Swansea Valley to the east of Pant-y-Blawd Road and the River Tawe and west of Upper Fforest Road, Morriston, Swansea, SA6 8PP. The approximate centre of the site is at National Grid Reference 2678 1981. The site location plan is provided in Figure A1 of Appendix A.

The site is set within the Swansea Enterprise Park. As such land to the west, east and south of the site comprises commercial / light industrial properties. Land to the north of the site is largely undeveloped although a site for 'travellers' which is believed to be Council owned is present to the north west of the site. The River Tawe is located 50 – 80 m from the north western site boundary.

1.2 Details of Installation

The Operator is authorised to carry out the primary activities and the associated activities specified below:

Section 6.2 Part A(1)(a) Production of carbon or hard burned coal by means of incineration or graphitisation.

Section 2.2 Part A(1)(d) Producing, melting or recovering by chemical means or by the use of heat, lead or/and lead alloy, if:

(i) the activity may result in the release into the air of lead; and
(ii) in the case of lead alloy, the percentage by weight of lead in the alloy in molten form is more than 23 per cent if the alloy contains copper and 2 per cent in other cases.

Section 4.2 A(1)(d) [….], any manufacturing activity, other than the application of glaze or vitreous enamel, involving the use of any of the following elements or compound of those elements or the recovery of any compound of the following element – antimony.

The above activities include the receipt of raw materials into the site, the dispatch of the finished product and the relevant processes described above.

At the present time there are no significant planned changes to operational layout or processes between the submission date of this report (i.e. within 2 months after permit issue) and the start of the process to collect the reference data (i.e. within 6 months of permit issue).

2.0 Objectives

The objectives of this report are:

- to demonstrate that sufficient Reference Data will be gathered at the installation by:
  - obtaining sufficient information with respect to the site to allow the development of the conceptual model of the site and its surroundings.
  - The completion of robust and adequate intrusive investigation, which would allow the collection of Reference Data for the Installation.

  (Please note that it is believed that sufficient intrusive investigation has already been undertaken at the site, and that relevant information from these investigations will constitute the Site Reference Data).

- to design a monitoring programme for the installation to:
  - monitor the effectiveness of pollution prevention infrastructure and provide early warning of any release of polluting substances to ground or groundwater.
  - to collect data on the condition of the ground at the installation to assist in the permit surrender process.
  - to monitor the movement of pollutants in the ground and / or groundwater beneath the site of the installation.

- to review and if necessary amend the inspection, testing and maintenance programme for pollution prevention infrastructure at the installation to ensure their continued integrity.

3.0 Intrusive Investigation to Collect Reference Data

3.1 Investigation and Sampling Strategy

Introduction

It is proposed that MECL should submit relevant reference data collected during a series of intrusive investigations as described below:

- Phase II Site Investigation, Morganite Electrical Carbon, Swansea – CH2M Hill, September 2003 (Site Works Completed in August 2003), Ref: 312884Final

- Phase I & II Investigation, Morganite Electrical Carbon, Swansea – ENVIRON, January 2004 (Site Works Completed in November 2003), Ref: 61-C7124G

- Delineation of Potential Hydrocarbon Contamination, Morganite Electrical Carbon, Swansea – ENVIRON, June 2004 (Site Works Completed in April 2004), Ref: 61C7575

No major environmental incidents or changes in process or land use occurred at the site between the period over which the above investigations were completed (i.e. August 2003 – April 2004). Similarly, no such changes have occurred between completion of these investigations and development of the Site Protection Monitoring Programme. It is therefore considered that data within these reports is comparable, and representative of the condition of the site as it currently stands.

It is noted that an earlier investigation was also completed by Exploration Associates Ltd. in 1997. Due to the time lapsed between this investigation and those listed above this information is not being considered as reference data, although it is of use in building and developing the Conceptual Site Model.

Due to the nature of the historic land use of the site as described within the ASR (i.e. a former tinplate and steel works) the previous reports included an assessment of a broad range of potential contaminants. The SPMP will focus on the analysis of materials that are or could be used within the installation between permit issue and permit surrender. All other analytical results will be omitted as they are not considered relevant to the operation of the IPPC permit.

MECL have produced this design SPMP in line with H7 Reporting Template 2 SPMP Design with Reference Data and will produce a report using H7 Reporting Template 4 SPMP Reporting Reference Data.

As MECL is required by Condition 4.1.7 to submit to the EA, within 2 months of the date of issue of the Permit, a Site Protection and Monitoring Programme (SPMP) design this report has been written using the 'future tense' (*i.e.* MECL **will** collect *etc.*) even though the reference data has already been collected.

3.1.1 General

This section provides a general overview of the investigations that have been completed at the site that are being considered suitable for site reference data. All investigations completed by ENVIRON were supervised by competent personnel and involved the use of suitable sub-contractors (i.e. service tracing companies, drilling contractors, etc). All contractors used by ENVIRON must be vetted and approved and agree to ENVIRON's site protocols and H&S requirements.

Sample locations were positioned to provide general coverage across the site and to target known potential sources of contamination. The detailed results of the CH2M Hill investigation are presented within the Application Site Report (ASR). Sampling locations were restricted due to location of current buildings and underground services (including foul/surface water drains, oil/water interceptors, gas, electric and water mains etc.).

Investigations undertaken at the site comprised the following:

CH2M Hill, September 2003, Ref: 312884

- The advancement of 7 No. boreholes using cable percussion techniques to a maximum depth of 6.2 m bgl. Ground conditions were logged, soil samples collected and screened for Volatile Organic Compounds (VOCs) using a photo ionisation detector, and selected samples were prepared for laboratory analysis. Four of the boreholes were installed with 50mm soil gas and groundwater monitoring wells.

- The excavation of 5 No. trial pits to a maximum depth of 2.5 m bgl.

- on site screening of soil samples for hydrocarbon vapours throughout the soil profile using a photo-ionisation detector (PID);

- submission of selected soil samples for a range of contaminants typically associated with current activities at the site;

- sampling of groundwater from the monitoring wells for analysis for a similar range of contaminants typically associated with current and future activities at the site; and

- on-site soil-gas testing from the boreholes.

ENVIRON, January 2004, Ref: 61-C7124G

- the advancement of twenty (#20) window sample holes to depths of up to 5.0m below ground level, using a hand held hydraulic window sampler. The window sample holes will be undertaken to permit sampling of the shallow soil horizon and provide an assessment of the soil conditions in the vicinity of potential sources of contamination. Three of the window sample holes were completed with 35mm soil gas and groundwater monitoring wells.

- the advancement of seven (#7) boreholes using shell and auger method (cable percussive) to a maximum depth of 9.0m in order to obtain information on both the shallow and deeper soil profile. One borehole was installed with a 50mm soil gas and groundwater monitoring well.

- on site screening of soil samples for hydrocarbon vapours throughout the soil profile using a photo-ionisation detector (PID);

- submission of selected soil samples for a range of contaminants typically associated with current activities at the site;
- sampling of groundwater from the monitoring wells for analysis for a similar range of contaminants typically associated with current and future activities at the site; and
- on-site soil-gas testing from the boreholes.

ENVIRON, June 2004, Ref: 61C7575

- the advancement of six (#6) boreholes using a rotary air flush technique to a maximum depth of 6.0 m bgl. Three of these boreholes were installed with 50mm groundwater monitoring wells and two were installed with 100mm wells.
- submission of selected soil samples for chemical analysis for oil hydrocarbons.
- sampling of groundwater from monitoring wells analysis for oil hydrocarbons.

The preliminary zoning of the site as described in Section 5.6 of the ASR is as follows:

Table 3.1.1a Site Zoning as Presented within the ASR

Zone	Geographical Description	Discussion
A	Inside Facility	The main building has a concrete floor that has been proven to be between 0.1 – 0.15m thick. The interior of the building drains to a storm water drainage network, which discharges to a surge pond prior to discharging to the nearby River Tawe.
B	Outside Facility (Impermeable Pavement)	Much of the exterior of the site has surfacing, either concrete or tarmacadam. This surfacing drains to the storm water drainage network, which discharges to a surge pond prior to discharge to the nearby River Tawe.
C	Outside facility – hard standing	Some areas of the exterior of the site have a porous surfacing, consisting either of turf or of gravel. Contaminant spills in these areas will discharge directly to the subsurface sediments.
D	Tar Oil Tank	The tar oil tank contains up to 22,730 litres of tar oil. The tank is bunded and covered.

The above table was transposed directly from the ASR (Ref: BU3787 Part B1.3.1 Site Report)

Taking into account the D2 Assessment of Liklihood of Land Pollution, the known findings of investigative works completed at the site, and comments raised within the issues PPC Permit, a refined site zoning that can be carried forward through the SPMP.

Table 3.1.1b Updated Site Zoning

Zone	Geographical Description	Discussion
1	Production Facility (Centre of site)	Concrete flooring limits potential for ingress of contaminants. However, hydraulic machine press pits provide a potential pathway to the sub surface.

2	Line 8 Scrubbers (Centre of site)	Wet scrubber used to reduce air emissions. Situated on concrete hardstanding.
3	Dilute Caustic Storage (Centre of site)	Transfer and storage of dilute sodium hydroxide in IBCs located in a bunded area between Electrical and Special Carbon buildings.
4	Diesel Tank and Chemical Store (North west of site)	Bunded shed used for the covered storage of liquid chemicals and oils. Also includes an above ground diesel tank within the shed.
5	Tar Oil Tank (South east of site)	The tar oil tank contains up to 22,730 litres of tar oil. The tank is bunded and covered.
6	Line 1 Scrubbers (South east of site)	Wet scrubber used to reduce air emissions. Situated on concrete hardstanding.
7	Solid Waste Storage (West of site)	Process solid wastes including carbon dust as well as general site solid wastes are stored on an area of hard standing in the west of the site.

3.1.2 Constraints on Investigations

All work will be undertaken in accordance with ENVIRON Safe Working Method #14, *Avoiding Danger from Underground Services*, which controls risk through a safe system of work by using service location plans for the site, where available, trained site investigation staff who are competent using cable avoidance tools (CAT & GENNY) and the use of competent service tracing company. In addition, ENVIRON field engineers will follow a number of Safe Working Methods (Nos. 1, 2, 3 & 5) designed to minimise risks primarily through safe working practices.

Prior to conducting the investigation ENVIRON will arrange for a service tracing company to trace below ground services at the site. During this process ENVIRON will agree all locations for intrusive works with both the service tracing company and with the facility management. These sample locations will be clearly mark identified on the ground and on a site plan. Where there is any doubt over a service which cannot be traced, ENVIRON will request a site visit from the appropriate utility provider or abandon locations in the immediate area.

In accordance with the ENVIRON Field Manual the following will be considered whilst designing the construction of the monitoring wells:

- Perched water in the made ground should not be 'connected' by well screen or filter pack with the main groundwater body;
- Separate aquifers should not be connected;
- Bentonite seals should be installed across the entire thickness of a 'barrier' (i.e. clay/silt layers or horizons of lower permeability than the surrounding strata) to prevent connecting water from above the barrier to that below;
- Barriers may be present at the base of a borehole and it may be necessary to install a bentonite seal at the bottom of a monitoring well; and
- It is good practice to 'bentonite up' a borehole if a monitoring well is not installed, not backfill with arisings.

ENVIRON will ensure that any confining layers that may restrict the migration of contaminants (normally vertically) would not be 'short circuited' by the installation of any monitoring well.

3.1.3 Soil Investigation and Sampling Techniques and Protocols

As discussed above, the proposed investigation will employ two principal investigation techniques. These are:

- Window Sampling (Driven Sampling);
- Cable Percussion Drilling;
- Rotary (Air Flush) Drilling.

These techniques are described in more detail below.

Window Sampling (Driven Sampling)

This technique will involve driving a plastic sampling tube into the ground using a percussive hammer mounted onto a drilling rig. The sampling tube itself is within steel casing which allows the window sample to be advanced in 1m lengths. After each 1m of drilling the plastic sampling tube is removed to allow the inspection and sampling of the 1m soil core. Further casing is added to allow the hole to be advanced to the desired depth and the processes repeated. This technique is sometimes also referred to as 'windowless sampling'.

Typical drilling rigs used include the Dando Terrier sampling rig, or the Competitor sampling rig. These are generally small track mounted rigs that can be located in areas where access is limited for larger drilling rigs.

The soil cores recovered using this method enable a detailed inspection of the ground conditions encountered and the recovery of disturbed soil samples. As such it is an appropriate and widely used method for investigating shallow soils. This method works best in relatively cohesive soils as sample retention in loose sands and gravels can be poor.

The window samples drilled using this method are generally 80 mm in diameter and as such there is the possibility of installing narrow diameter groundwater monitoring wells.

In the context of this proposed investigation, this method has been included primarily to achieve:

- recovery of soil cores from shallow soils (0-5 m bgl);
- logging of soil conditions using the recovered cores;
- provide representative soil samples for laboratory analysis; and
- allow for the installation of gas and groundwater monitoring wells.

Where monitoring wells are not installed, window sample locations will be backfilled using bentonite.

Given that the anticipated geology at the site (made ground over silty sands underlain by Coal Measures) this investigative method is believed to be appropriate.

Cable Percussion Boreholes

This technique (also known as Shell and Auger drilling) allows the drilling of boreholes through superficial or unconsolidated deposits. 150 mm diameter casing (the shell) is advanced into the ground using a cable mounted drop weight operated via a diesel powered winch. Soil within the casing is then recovered by dropping a weighted auger inside the casing. Further lengths of casing are added to extend the borehole to the desired depth. Ground conditions can be determined through inspection of the soil arisings.

The boreholes drilled using this method are 150mm in diameter and as such allow the installation of 50 mm gas and groundwater monitoring wells.

Cable percussion drilling has been recommended in order to achieve the following:

- The logging of ground conditions, including any evidence of contamination, between 0-10 m bgl;
- The recovery of disturbed soil samples for laboratory analysis; and
- The installation of 50 mm groundwater monitoring wells.

Rotary (Air Flush) Drilling

This technique is generally used for drilling through consolidated bedrock or where ground conditions in unconsolidated deposits do not allow cable percussion drilling (i.e. where there are large obstructions, concrete bases, etc). A borehole, generally between 110 mm – 150 mm diameter, is advanced into the ground using a track or lorry mounted drilling rig. This is normally driven by a separate air compressor. The rotary motion of the drilling stem coupled with the action of the drill bit (usually either a 'rock roller' or 'down hole hammer' breaks the rock into small fragments, approximately the size of coarse sand depending on the ground conditions. Compressed air is fed to the bottom of the borehole via the drill stem which then lift the rock fragments to the surface.

As the solid material received at the surface is highly disturbed, this method is not generally recommended where a detailed assessment of ground conditions or solid phase contamination (particularly volatile organic compounds).

In the context of MECL, this drilling methodology is to be used to allow the advancement of boreholes to sufficient depth to allow the installation of groundwater monitoring wells.

Given that the anticipated ground conditions at the site are made ground comprising dense steel work slag and rubble overlying Alluvial Deposits these methods are believed to be appropriate.

3.1.4 Groundwater Investigation and Sampling Techniques and Protocols

All groundwater wells shall be established using the procedure detailed in the ENVIRON Field Manual (Procedure 2 – *Installation of Monitoring Wells*). Once completed all groundwater collection will be undertaken using the procedure detailed in the ENVIRON Field Manual (Procedure 3 – *Groundwater Monitoring).*

These ENVIRON procedures are presented in *Appendix B*.

3.1.5 Soil-Gas and Vapour Investigation and Sampling Techniques and Protocols

Soil Gas
Soil-gas will be monitored in selected boreholes and within selected installed window sample locations. Gas monitoring will be undertaken in accordance with the procedure as detailed in the ENVIRON Field Manual (Procedure 4 – *Land Gas Monitoring*).

Headspace Testing
Solvents, degreasing agents and petrol compounds are common industrial contaminants that potentially may be present on many industrial sites. It is standard ENVIRON practice to headspace test soil samples in the field. This is a rapid screening method, which is useful for giving an indication of the presence of such volatile organic compounds in soils. It is not a substitute for laboratory chemical analysis; rather it can be used to help determine which samples should be analysed. The procedure involves the testing of soil gas headspace using Photo-ionisation Detector (PID).

Selected soil samples will be headspace tested using a PID in accordance with Procedure 6 – *Soil Gas Headspace Testing,* as detailed in the ENVIRON Field Manual.

The listed procedures are presented in *Appendix B*.

3.1.6 Surface Water Investigation and Sampling Techniques and Protocols

No investigation and sampling of surface water is planned at the Installation.

3.1.7 Infrastructure Investigation and Sampling Techniques and Protocols

The infrastructure investigation and sampling techniques that could be used by MECL include:

- Visual Inspection;
- Pressure tests of tanks and pipework;
- Leak testing of tanks and pipework;
- CCTV inspection of drains and sumps; and
- Ultrasonic testing of tanks and pipework.

Visual Inspection

Visual inspection provides the basic element for evaluation of structures and/or components. Regular planned inspection of plant and equipment by competent maintenance engineers are used by MECL to determine the presence of leaks, spills, damage and to identify general wear and tear. All inspections are recorded as are corrective actions when they are required.

Visual inspection will be utilised on all above ground plant and equipment.

Leak Testing and Pressure Testing

Traditionally leak detection has been based on periodic tank and pipework testing together with the identification of stock losses or gains by in-house inventory checking (wet-stock control). This traditional approach generally does not provide sufficient protection during the periods between tank and pipework tests. Developments in tank and pipework design together with improved systems of leak detection which operate continuously are proving to be more effective at preventing leaks. When a suitable leak detection system is in place there will not be a need for periodic tank and pipework testing.

CCTV Inspection

Pipe and drain defects and structural integrity reports can be provided on pipework from 50mm diameter to "man entry sewers" using compact camera survey units, HPW crawler units or tractor units. An alternative to CCTV surveys is the use of electronic or sonar drain tracing to plot the route of drainage systems and air/smoke testing to determine the structural integrity of the pipework.

Ultrasonic Testing

Ultrasonic thickness testers can cope with many different types of metal thicknesses and many different materials. The testers measure and display metal thickness by simply placing a small probe against the skin of the object. They have built-in thickness gauges for checking and verification.

MECL will implement the most appropriate techniques given the prevailing site conditions and equipment that is in use. These requirements are described within *Section 4.4*.

3.2 Sample Locations

Sample locations were chosen with reference to the sources, pathways and receptors identified within the conceptual model for the site, as detailed in the ASR, and with reference to the refined site zoning presented in *Section 3.1.1* above. It should be noted that additional site sampling has been completed across the site, however, this section refers only to those sampling points relevant to the requirements of the PPC Permit.

Sample locations where groundwater wells will be established will be surveyed in and will have a vertical accuracy of 0.01m bgl.

Proposed sample locations for the site are presented in *Figure A2* of Appendix A.

Discussion of the selection, justification and design for each sample location with respect to individual zones for the site are given in the following sections.

Samples will be referenced using the following classification system:

Investigation Method + Unique ID
i.e. BH1 (Borehole One) or WS1 (Window Sample One)

Please note the terms window sample (WS) and power auger (PA) are used interchangeably throughout this report.

3.2.1 Zone 01 – Production Facility ('Low Possibility of Pollution')

Zone 01 is the main production facility occupying the majority of the centre of the site. As this is entirely covered by concrete flooring proven to be between 0.1 – 0.15m in depth which is currently in good condition, the possibility of pollution is considered to be low.

However, the 'cheesing' hydraulic machine presses including oil sumps are located in the north of the production facility (i.e. in the centre of the site). As described within the D2 assessment within the ASR primary containment for the oils is the hydraulic presses themselves which are inspected and maintained regularly through their operation by appropriately trained personnel. The sumps act as secondary containment. The overall possibility for pollution in this area was therefore considered to be low.

It is considered to be prudent to assess ground conditions in this area as historic operation of the presses could have resulted in the release of oils to ground.

Two boreholes **(CH2M Hill BH4 and CH2M Hill BH5)** will be excavated in the vicinity of the press pits.

3.2.2 Zone 02 – Line 8 Scrubbers ('Low Possibility of Pollution')

Wet scrubbers are used at the facility to remove potential airborne pollutants to acceptable levels. Line 8 Wet scrubbers are located on the north eastern corner of the main production building. During the ASR, water leakage was noted from the base of the wet scrubbers. Potential contaminants associated with these scrubbers include carbon dust and pitch fume (including PAHs) mixed with water.

Condition 5 within the issued PPC permit requests the 'the Operator shall provide the Agency, in writing, an assessment of the likelihood of land pollution from the failure of the wet scrubbing abatement plant.'

It is considered that the most effective means of achieving this is through the sampling of the waters within the scrubbing plant to establish the concentrations of potential contaminants present. These results can then be considered with the conceptual model of the areas around the scrubbers to establish the likely outcome of failure of the plant.

3.2.3 Zone 03 – Above Ground Dilute Caustic Storage ('Reasonable Possibility of Pollution')

Wastewater from a resin impregnation caustic washing process is stored in IBCs in the centre of the site. This contains dilute sodium hydroxide. Bunding of these tanks was found to be insufficient at the time of the ASR and therefore there was believed to be a reasonable possibility of pollution.

One borehole **(BH D)** will be advanced in the vicinity of the dilute caustic storage area to establish ground and groundwater conditions.

It is noted that improvement of the bunding in this Zone has since been improved by MECL.

3.2.4 Zone 04 – Above Ground Diesel Tank and Chemical Store ('Reasonable Possibility of Pollution')

The chemical store is located in the far north western corner of the site can comprises a steel framed metal clad shed with a bunded concrete floor and an open frontage. The building is used for the storage of oils and waste oils, primarily in 205 litre drums.

The store also houses an above ground diesel storage tank. Visible evidence of staining was observed during completion of the ASR. Condition 4 of the issued PPC permit requests that 'The Operator shall carry out corrective action to the fuel transfer system…..to reduce the likelihood of pollution from these areas.'

3 No. window sample holes **(WS2, WS3, and WS4)** and 1 No. borehole **(BH A)** will be installed in the vicinity of the chemical store shed (which includes the diesel tank) to determine the ground and groundwater conditions.

3.2.5 Zone 05 – Above Ground Tar Oil Tank ('Reasonable Possibility of Pollution')

Tar oil is used as a binding agent during the production which is carbonised during the heat treatment phase of the process. Tar oil is stored within a single 22,730 litre above ground storage tank which is bunded and covered. Minor staining to concrete hard standing was noted during the

completion of the ASR. This staining was believed to have occurred during the decoupling of delivery pipework.

1 No. borehole **(BH7 CH2M)** will be installed in the vicinity of the tar oil tank to establish ground and groundwater conditions in the area.

3.2.6 Zone 06 – Line 1 Scrubbers ('Low Possibility of Pollution')

Comments as per Line 8 scrubbers above. The Line 1 scrubbers are on the south eastern corner of the main production building.

Impact of the Line 1 scrubbers will be determined as described for the Line 8 scrubbers above. In addition, 1 No. window sample hole **(WS11)** will be installed adjacent to the scrubber plant to establish ground and groundwater conditions in the area.

3.2.7 Zone 07 – Solid Waste Handling Area ('Low Possibility of Pollution')

The majority of solid wastes produced during the operation of the facility are handled and stored via the solid waste handling area. This includes areas of hardstanding to the north of the main production building where solid wastes are collected in drums and bulk bags. This area of hardstanding extends to the north west of the production building where waste solids are stored in dedicated skips and drums.

6 No. window sample holes **(WS1, WS5, WS6, WS8, WS14 and WS20)** will be installed within this zone to establish ground conditions in the area. In addition, 1 No. borehole **(BH6 CH2M)** will be installed between this area and the northern site boundary to provide a monitoring point to establish any migration towards the River Tawe.

Table 3.2a Proposed Chemical Analysis for Soil Samples recovered as reference data

	Zone 1		Zone 3	Zone 4				Zone 5	Zone 6		Zone 7						
	BH4 CH2M	BH5 CH2M	BH D	WS2	WS3	WS4	BH A	BH7 CH2M	Scrubber Sample	WS11	WS1	WS5	WS6	WS8	WS14	WS20	BH6 CH2M
Proposed number of samples	1	1	2	2	2	3	0	1	1	3	1	2	1	1	0	1	0
Target/Non-target	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	NT
pH				X	X	X				X	X	X	X	X		X	
Sulphate as SO4	X	X		X	X	X		X		X	X	X	X	X		X	
Monohydric Phenol				X	X	X				X	X	X	X	X		X	
Total Phenols	X	X						X									
Total Cyanide	X	X		X	X	X		X		X	X	X	X	X		X	
PAH screening				X	X	X				X	X	X	X	X		X	
Hydrocarbon Oils by IR																	
TPH by GCFID				2	2	1				X		X	X	X		X	
Petrol Range Organics	X	X						X									
Diesel Range Organics	X	X						X									
Arsenic	X	X		X	X	X		X		X	X	X	X	X		X	
Cadmium	X	X		X	X	X		X		X	X	X	X	X		X	
Chromium	X	X		X	X	X		X		X	X	X	X	X		X	
Lead	X	X		X	X	X		X		X	X	X	X	X		X	
Mercury	X	X		X	X	X		X		X	X	X	X	X		X	
Selenium	X	X		X	X	X		X		X	X	X	X	X		X	
Copper	X	X		X	X	X		X		X	X	X	X	X		X	
Nickel	X	X		X	X	X		X		X	X	X	X	X		X	
Zinc	X	X		X	X	X		X		X	X	X	X	X		X	
VOC				1	1	1				1		1		X		X	
BTEX	X	X						X									
SVOC				1	1	1				1		1	X	X		X	
PCB					1					1	X	1		X		X	

Note: 'X' = All Samples will be analysed, '1' = 1 No. sample will be analysed, '2' = 2 No. samples will be analysed

Table 3.2b: Proposed Water Analysis Schedule for the Boreholes						
	BH5 CH2M	BHD	BHA	BH7 CH2M	WS11	BH6 CH2M
Proposed number of samples	1	1	1	1	1	1
Target/Non-target	T	T	T	T	T	T
Target Zone	1	2	3	4	5	6
pH					X	
Sulphate as SO4 mg/l	X			X	X	X
Sulphide	X			X		X
Monohydric Phenol					X	
Total Phenol	X			X		X
Total Cyanide	X			X	X	X
TPH (PRO+DRO)	X			X		X
TPH (GC-FID)		X	X		X	
Total PAH	X			X	X	X
Arsenic	X			X	X	X
Cadmium	X			X	X	X
Chromium	X			X	X	X
Hexavalent Chromium	X			X		X
Lead	X			X	X	X
Mercury	X			X	X	X
Copper	X			X	X	X
Nickel	X			X	X	X
Zinc	X			X	X	X
Antimony	X			X	X	X
VOC	X	X	X	X	X	X
SVOC					X	

Note: All boreholes will be installed with 50 mm groundwater monitoring wells and therefore groundwater samples will be recovered from each.

3.3 Analytical Strategy

3.3.1 Justification of Analytical Suites

The analytical suite for each Zone was chosen by reviewing *Table C1* in *Appendix C.* It is important to note that Table C1 only includes those Zones where it was assessed that there was a 'Reasonable Possibility of Pollution' based on the categories listed in Table D2 of the ASR (as reviewed in *Section 3.1.1* of this document), and following review of the issued PPC permit.

Selection of analytical parameters and suites has been based on the following:

- objectives of the investigation described in *Section 3.0*;
- the conceptual model and zoning described in the original ASR; and
- any observations made during the subsequent investigations and sampling

It is noted that potential off site sources including the historic use of the area for metal production and general manufacturing is likely to have had an impact on the local groundwater quality.

3.3.2 Justification of Analytical / Field Technique and Detection Limits

The laboratory analytical technique for each analysis is referenced in *Appendix C*.

No field testing of samples will occur beyond the testing of soil gas headspace using a Photo-ionisation Detector (PID) This will be undertaken for selected samples in accordance with the ENVIRON Field Manual (Procedure 6 - *Soil Gas Headspace Testing*).

Detection Limits for each analytical and field technique are shown in Appendix C.

The detection limits used by the laboratory are determined on the basis of approved and certified analytical methods that are used routinely in the UK for land and water contamination assessments and bespoke limits and methods have not been applied for this site.

Initially, substances will be analysed in soil phase and groundwater phase only. Pore water analysis will not be undertaken. If required, leachate data or theoretical calculations can provide an estimation of this phase. If identified, free product will be sampled and analysed separately from groundwater in order to characterise the chemical and physical properties of the product.

Analytical techniques and detection limits are provided in *Appendix C*. Chemical analysis will be undertaken by an accredited environmental laboratory. Where possible, the analytical technique employed will be MCERTS accredited. All of the analytical methods for the chosen parameters are accredited by UKAS (United Kingdom Accreditation Service). It should be noted however that the investigation works completed to date were largely undertaken prior to the introduction of the MCERTs scheme.

Typically ENVIRON uses a small number of specialist environmental testing laboratories. These Laboratories participate in recognised inter-laboratory comparison programmes and the following external proficiency testing schemes to help maintain performance standards:

- Soil Chemistry - CONTEST, British Gas, Aquacheck.

- Water Chemistry - LEAP.

The laboratories have also been audited by ENVIRON and ENVIRON is satisfied that the laboratory is adequate and sufficiently expert and thorough to perform the analysis of the samples competently and consistently.

3.3.3 Laboratory Accreditation / Quality Assurance and Quality Control

Laboratory Accreditation

ENVIRON propose (depending upon availability at the time of the sample collection) to use ALcontrol Technichem in order to undertake the analysis of collected soil and water samples.

Technichem Laboratories Ltd was established in 1987 as an independent testing laboratory offering a wide range of services to the environmental market. ALcontrol Laboratories acquired Technichem in July 2001. Employing over 60 staff and occupying 15,000 feet, ALcontrol Technichem specialise in a full range of analysis for soils, waters and gases. It also has a specialist asbestos department

ALcontrol Technichem holds UKAS accreditation to ISO 17025 (as well as ISO 17020 as an asbestos inspection body) for a wide range of analysis, including asbestos, and also participates in RICE, AIMS, CONTEST, Aquacheck and RT Corporation proficiency testing schemes.

It is important to note that ALcontrol Technichem are presently revalidating the majority of methods to meet MCERTS requirements, this may result in some detection limits altering from those quoted. ISO 17025 status is according to UKAS Schedule Version 15.

ALcontrol Technichem is currently accredited to the MCERTS standard for:

- 025a Total Sulphate;
- 032 Elemental Sulphur; and
- 016 Water Soluble Boron.
- 009 pH;
- 061 Total Cyanide & Thiocyanate;
- 053 SVOC (53 of 65 compounds reported);
- 065 Rapid TPH;
- 070 EPH;
- 022s Speciated PAH (13 of 16 compounds);
- 039 PCBs (5 of 7 ices congeners);
- 071 Extended VOC list (35/62 compounds); and
- 020 Phenols by HPLC (excluding naphthol);

In addition, the following procedures hold UKAS accreditation, although Alcontrol are currently working towards MCERTs accreditation:

- 019 Loss on Ignition;

- 073 Water Soluble Sulphate, Nitrate & Chloride by Dionex;
- 074 Water Soluble Sulphate by ICP-OES;
- 068 VPH; and
- 069 AS, Cd, Cr, Pb, Hg, Se, Cu, Ni, Zn

Quality Control

The chosen laboratory, ALcontrol Technichem, will be required to demonstrate that adequate quality control (QC) procedures have been applied and that the performance of the various methods are acceptable.

Where appropriate an analytical report will be required that would carry details of the QC procedures used during the various analyses.

It is standard operating practice within each ALcontrol Technichem laboratory to run 'Certified Reference Materials', where available, alongside samples. Where these are not available or appropriate, spiked samples or internal reference materials and standards are run. QC charts are plotted and where failures occur, results are reported and internally investigated.

A sampling and analytical quality assurance and quality control plan will be presented to the EA with specific QA/QC data when the reference data is collected.

4.0 Monitoring Programme

4.1 Objectives of the Monitoring Programme

4.1.1 Objectives of Environmental Monitoring Programme

Environmental Monitoring is defined as the collection of physical samples or data relating to the presence and / or concentration of potentially polluting substances in, on or under land and within groundwater.

The objectives of the environmental monitoring programme will include:

- Monitoring the effectiveness of infrastructure and management procedures and provide a warning of loss of containment.
- Assisting during the permit surrender process by:
  - determining the movement of pollutants onto or off the site of an installation.
  - determining the movement of pollutants within a site.
  - providing data on long term trends.

4.1.2 Objectives of Infrastructure Monitoring Programme

Infrastructure Monitoring is defined as the use of a programme of integrity testing, inspection and maintenance to prove the continued integrity of pollution prevention infrastructure at an installation.

The objectives of Infrastructure monitoring programme for the installation are to:

- Monitor the effectiveness of pollution prevention infrastructure and provide early warning of any release of polluting substances to ground or groundwater
- To review and if necessary amend the inspection, testing and maintenance programme for pollution prevention infrastructure at the installation to ensure their continued integrity.

The purpose of the infrastructure monitoring programme is to demonstrate the effectiveness of pollution prevention measures at the site throughout the life of the Permit. This occurs through a process of planned inspection, testing and maintenance of infrastructure. The infrastructure monitoring programme will also include a system for the regular assessment, recording and reporting of monitoring results.

4.2 Environmental Monitoring Infrastructure

4.2.1 Location

A total of six (#6) long term groundwater monitoring points will be utilised at the site. These are as per those points described within *Table 3.2* above. The location of these points is shown in Figure A2, Appendix A.

4.2.2 Groundwater monitoring

Groundwater monitoring will be undertaken in accordance with ENVIRON's standard working practices described in Appendix B. Monitoring frequency is discussed below. Any incidents or unplanned occurrences would be reported and cleaned-up in accordance with EA recommended practices.

4.2.3 Soil Vapour Monitoring

No on-going soil vapour monitoring will occur at the installation during the life of the permit as contamination of soils and ground waters by volatile substances is not foreseeable based on the current and ongoing Installation activities.

4.2.4 Soil Monitoring

No on-going soil monitoring will occur at the installation during the life of the permit beyond that conducted during the collection of the initial reference data. On closure of the Installation, however, a closure investigation will determine the chemical contamination status of the site at that time.

4.2.5 Procedure for the Inspection and Maintenance of Environmental Monitoring Infrastructure

In order to ensure that the groundwater monitoring wells remain operable (i.e. damage free, unsilted) the site will ensure that the groundwater wells are added to a 6 monthly PPM maintenance schedule. This schedule will include the following items:

- Well is still locatable (i.e. free from traffic, storage of materials and wastes)
- Well cover remains in a good condition and is free from damage (i.e. still can be easily opened, prevent ingress of surface water)
- Well depth to base (i.e. this will be compared to the initial construction depth to determine rate of silting within well)
- Purging of the well to determine continued sample availability (i.e. could a representative groundwater sample be obtained).

4.3 Environmental Monitoring Programme

4.3.1 Monitoring Frequency

Groundwater monitoring, in accordance with the ENVIRON monitoring and sampling protocols provided in Appendix B, will be completed as described in the table 4.3.1 below.

Table 4.3.1 Proposed Environmental Monitoring Frequency

Year	Monitoring Frequency
1	All wells will be monitored and sampled on a six monthly basis
2	All wells will be monitored and sampled on an annual basis
3	All wells will be monitored and sampled on an annual basis
4-5	All wells will be monitored and sampled every 2 years.

The monitoring frequency and wells included within the monitoring programme will be reviewed on an annual basis.

In the event of an emergency incident, or in the event that monitoring indicates a significant increase from reference data, the frequency of monitoring will be increased. The frequency of monitoring will depend on the nature and extent of any incident or increase in concentrations. Professional advice will be sought in this event. The Environment Agency will be informed of any environmental incident, and of the monitoring or contingency measures put in place following such an event.

4.3.2 Sampling and Analysis Protocols

Sampling protocols will be as per those described for the gathering of Site Reference Data.

The chemical analysis of groundwater samples will be targeted at those contaminants potentially present in the appropriate Zone. The proposed analysis of groundwater samples recovered during routine monitoring is as presented in *table 4.3.2* below.

Table 4.3.2 Proposed Analysis of Groundwater Samples

	BH5 CH2M	BH D	BHA	BH7 CH2M	WS11	BH6 CH2M
pH	X	X	X	X	X	X
Major Ions (Na, K, Mg, Ca, Fe, Alkalinity, Ammonia, Chloride, Nitrate)	X	X	X	X	X	X
Total Organic Carbon	X	X	X	X	X	X
TPH (IR)	X		X	X		X
PAH			X	X	X	X
VOC	X		X	X		X

Analytical protocols employed during routine monitoring will be as per those described for the collection of Site Reference Data.

4.3.3 Personnel Issues

Personnel responsible for sampling, maintenance and inspection will be trained in environmental monitoring to an appropriate level to ensure compliance with the quality assurance and quality control plan.

Senior Management at MECL have appointed a Management Representative (the Manufacturing Systems Manager) who has overall responsibility for establishing and maintaining the EMS and managing environmental issues such as IPPC throughout the site.

As required the Manufacturing Systems Manager will utilise professional services to augment internal skills.

4.4 Infrastructure Monitoring Programme

The following text is reproduced from the Environment Agency's Technical Guidance Note H7 "Guidance on the Protection of Land under the PPC Regime: Application Site Report and Site Protection and Monitoring Programme".

The purpose of the infrastructure monitoring programme is to demonstrate the effectiveness of pollution prevention measures at the site throughout the life of the Permit. This occurs through a process of planned inspection, testing and maintenance of infrastructure.

The infrastructure monitoring programme must also include a system for the regular assessment, recording and reporting of monitoring results.

Systems may already be in place at an installation that cover some or all of the requirements of an SPMP. These may include:

- An EMS to ISO:14001 (or similar accredited scheme);
- A Planned Preventative Measures and Maintenance Programme;
- An inspection and testing programme compliant with appropriate industry standards;
- An inspection, testing and maintenance programme in accordance with infrastructure manufacturers recommendations;
- An inspection, testing and maintenance programme to comply with Health and Safety Regulations.

In-line with EA guidance various infrastructure elements, such as primary, secondary and tertiary containment systems, were described within the original IPPC application. In order that these structures are maintained it is necessary to inspect and, where required, test the various structures in order to demonstrate continued integrity.

The overall aim of the inspection and testing techniques are to ensure that fugitive emissions to ground, surface water, sewer and groundwater are prevented.

Various classes of structures have been identified according to the following groups:

- Subsurface structures – i.e. below ground pipework, sumps, pits etc;
- Primary containment – i.e. drums, IBCs, process tanks, rinse tanks, above ground bulk storage tanks, above ground pipework etc;
- Secondary containment – i.e. permanent bunded areas, mobile bunded areas (i.e. drum and IBC bunded pallets etc.);
- Tertiary containment – i.e. site roadways, waste storage areas, material handling areas etc.

In-line with the EA guidance the following processes and procedures have been considered during the production of this SPMP.

Table 4.2: EA Recommended inspection and testing regime

Structure	EA Recommendation
Subsurface structures	For all subsurface pipework and sumps confirm that one of the following options is in place: (1) secondary containment, or (2) continuous leakage detection or (3) an inspection and maintenance programme, e.g. pressure tests, leak tests, material thickness checks or CCTV which are completed for all such equipment within the last 3 years and are repeated at least every 3 years
Primary containment	For all storage vessels confirm that one of the following options is in place: (1) secondary containment, or (2) continuous leakage detection or (3) an inspection and maintenance programme, e.g. pressure tests, leak tests, material thickness checks or CCTV which are completed for all such equipment within the last 3 years and are repeated at least every 3 years. Storage containers (i.e. drums and IBCs) should be clearly labelled, stored with lids, caps, valves etc. in place and are secured; and are regularly inspected and where damage is found replaced or repaired.
Secondary containment	Secondary containment is subject to frequent visual inspection for contents such as leaks and spills. Where not frequently inspected, are fitted with a high-level probe and an alarm as appropriate. Shall ensure that any contents are pumped out or otherwise removed under manual control after checking for contamination. Shall also have a routine programmed inspection and structural integrity check of the secondary containment (normally visual). Where structural integrity is in doubt are subject to water testing.
Tertiary containment	Inspection and maintenance programme of impervious surfaces and containment kerbs.

Table 4.3: EA Recommended inspection frequencies by type							
Area	**Type**	**Visual inspection**			**Non-Destructive Testing**		
		Leaks and Spills	**Structural Integrity**	**CCTV checks**	**Pressure tests**	**Leak tests**	**Ultrasonic Testing**
Subsurface Structures	Sumps & pits		Annually			5 years	
	Below ground pipework			3 years	10 years		
Primary Containment	Drums	Daily	As and when used				
	IBCs	Daily	As and when used				
	Process tanks/baths	Daily	6-monthly inspection				5 years
	Bulk storage tanks	Daily	Externally annually Internally every 2 years		10 years	5 years	5 years
	Above ground pipework		6-monthly		10 years		
Secondary Containment	Permanent bunded areas	Daily	6-monthly			5 years	
	Local drum storage pallets	Daily	Annual condition assessment checks				
Tertiary Containment	Roadways	Daily	Annual condition assessment checks				
	Waste storage areas	Daily	Annual condition assessment checks				
	Material handling areas	Daily	Annual condition assessment checks				
	Other hardstanding areas	Daily	Annual condition assessment checks				

4.4.1 Personnel Issues

Personnel responsible for the inspection, testing and maintenance of pollution prevention infrastructure are to be trained to an appropriate level to ensure compliance with the Infrastructure Monitoring Programme. Roles and responsibilities for undertaking the Programme (including reporting) and ensuring adequate competence will be developed.

As part of the implementation of their Environmental Management System MECL will be instigating a formalised training process to ensure that all persons whose activities could have a significant impact on the environment, including contractors and visitors, have received adequate training and/or information.

4.5 Assessment and Reporting Procedures

4.5.1 Assessment Procedure

Analytical results of soil samples recovered during this investigation will be compared against initial screening criteria. Where available, these criteria will include Soil Guideline Values as described within the Contaminated Land Assessment Exposure Assessment (CLEA) model. It should be noted that SGVs relate to acute human health risks only and do not indicate the potential for risks to controlled waters.

Ground and surface water analysis results will also be compared to initial screening criteria. These will include Environmental Quality Standards for surface waters and Drinking Water Standards for groundwater as a guide but it is not an expectation that the groundwater will be at drinking water quality standards.

Discharges to sewers or surface waters will be compared to the relevant discharge consent criteria.

4.5.2 Reporting Procedure

Summaries of the monitoring data will be sent to the Environment Agency on the 31st of January each year along with the results of the data assessment, and any recommendations for amendments to the Monitoring Programme.

The site's Environmental Manager will be responsible for ensuring that the annual reports are submitted by the required date.

Emergency Preparedness and Response

MECL has established and maintains documented procedures for the identification and assessment of abnormal and emergency situations. These systems were summarised in the original IPPC application.

4.5.3 Recording and Data Management

MECL has established and maintains a documented process for regularly measuring and monitoring the main characteristics of the operations that may have an impact on the environment, these include:

- Emissions as waste;
- Emissions to air;
- Emissions to water;
- Energy usage;
- Environmental incidents;

Where appropriate all monitoring equipment is calibrated and records of calibration kept.

5.0 Other Issues

It is noted that during previous investigative works, a localised area of free product was identified in the north west of the site. This was associated with the presence of a former above ground storage tank which contained a recycled heating oil, and as such represents historic contamination and is not associated with the current operation of the site.

This contamination has been subject to a risk assessment and it has been demonstrated that it does not present a significant risk to the River Tawe. The area is subject to an improvement and monitoring programme being implemented by MECL.

All information associated with this contamination has been forwarded to the Environment Agency.

6.0 References

References are quoted within the main sections of text where relevant.

7.0 Glossary

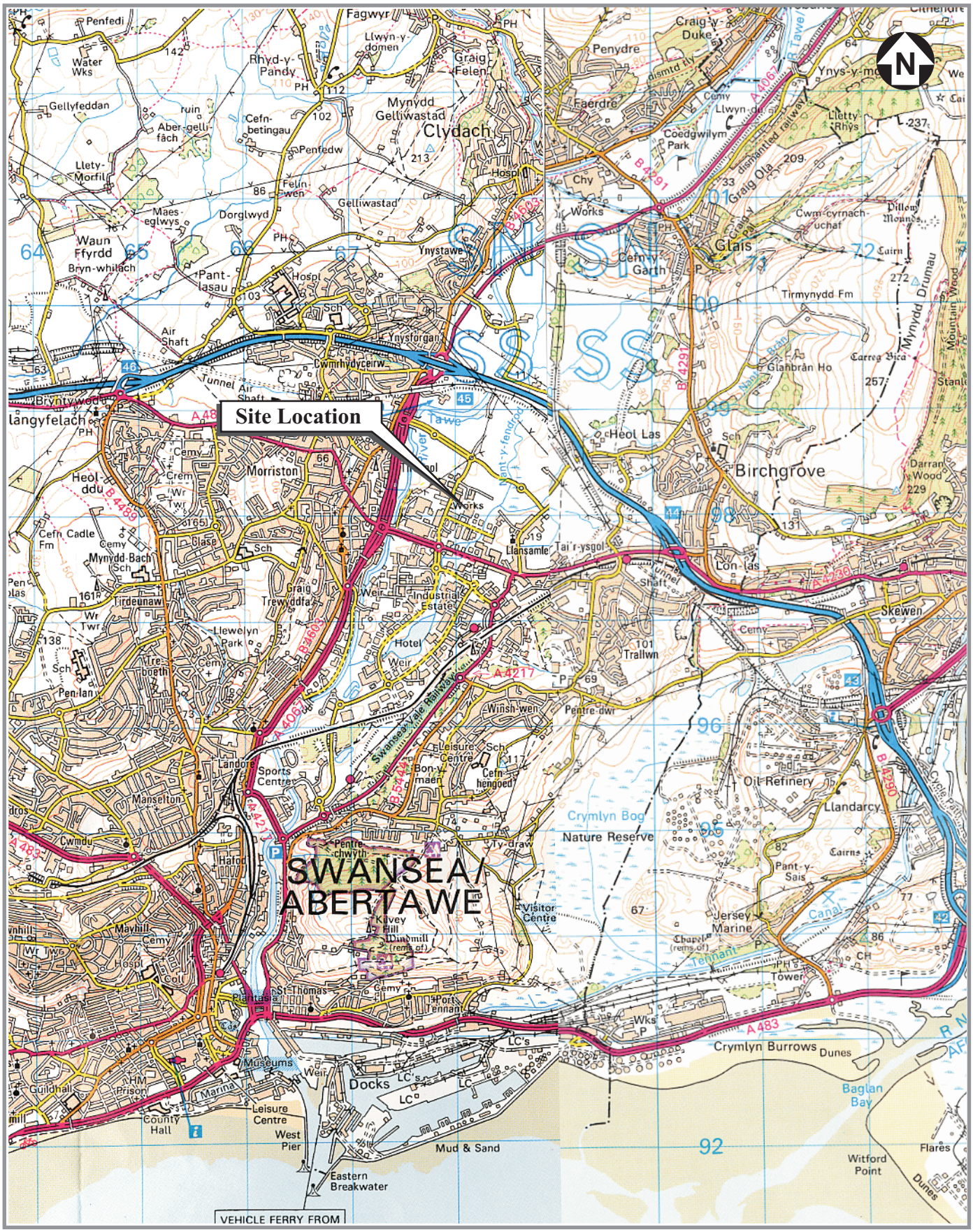
Not required – technical terms are discussed in the text.

APPENDIX A

FIGURES AND PLANS

Contents

Figure A1
Site Location Plan



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Client	**Morganite Electrical Carbon Ltd**		
Scale	**1:50,000**	Date	**July 2005**
Project No	**64-C9057**	Drawn by	**JC**

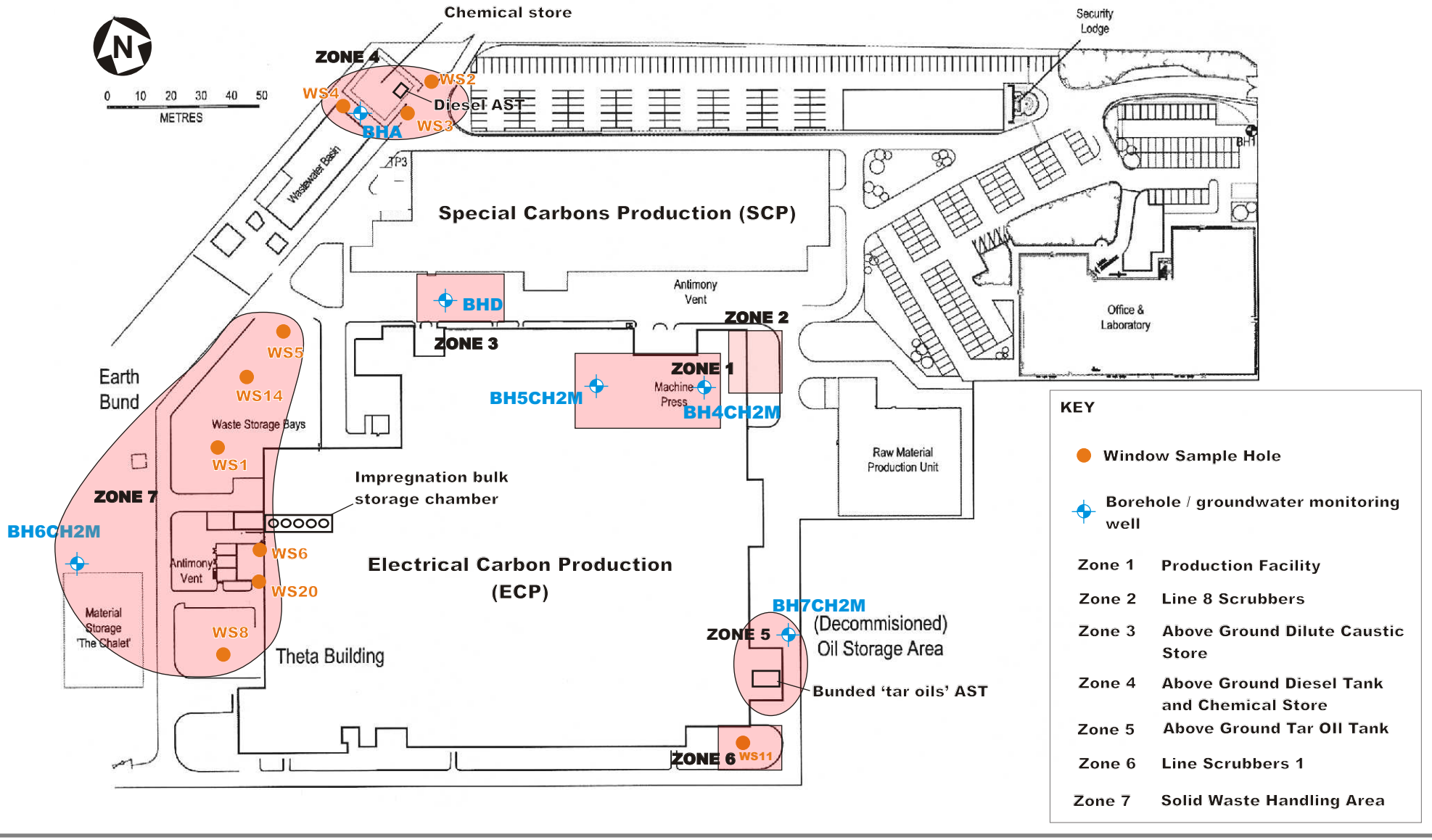

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Figure A2
Sample Location Plan

Client	**Morganite Electrical Carbon Ltd**		
Scale	**NTS**	Date	**July 2004**
Project No	**64-C9059**	Drawn by	**JC**

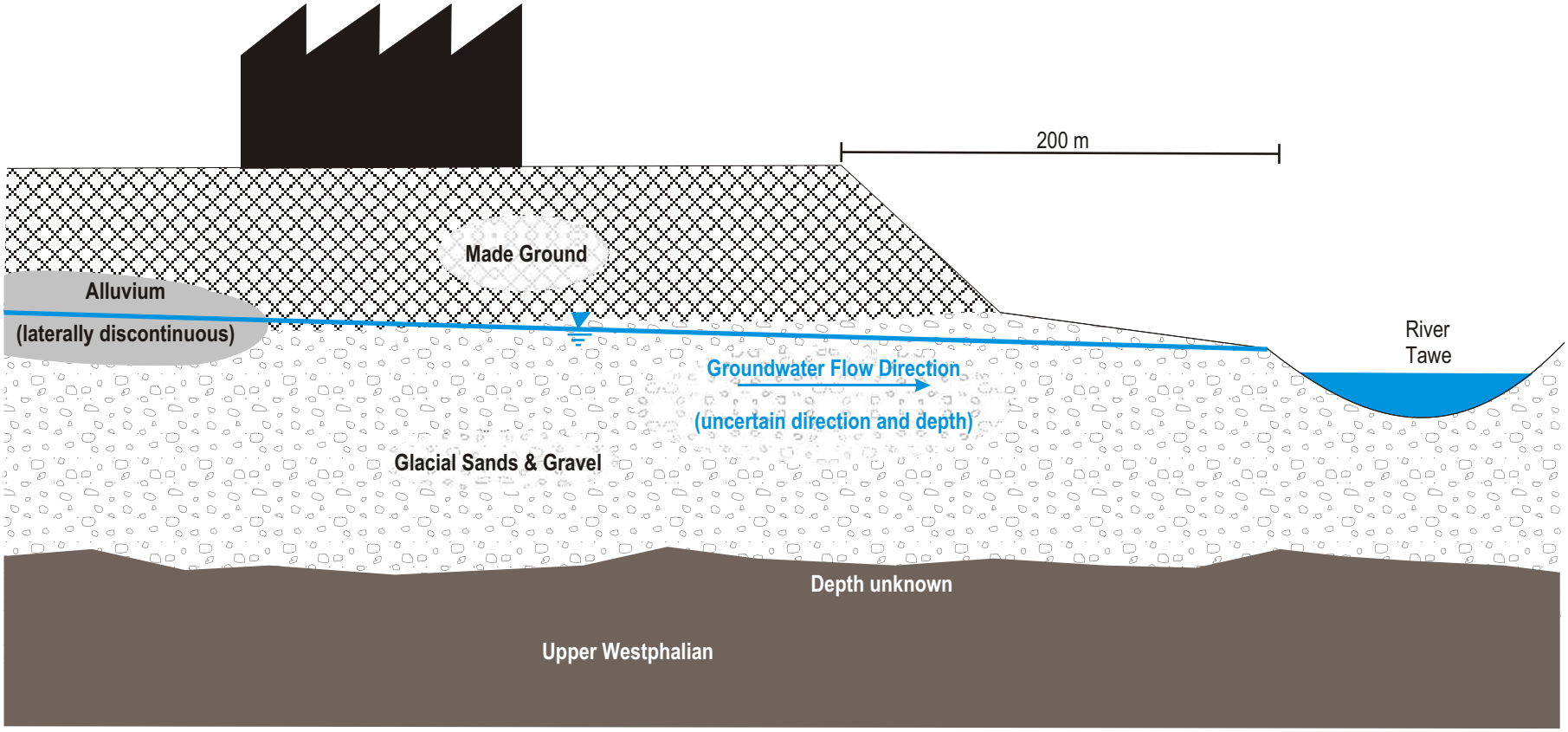


Figure A2-2
Conceptual Cross-Section of the Site
Morgan Crucible, Swansea

APPENDIX B

INVESTIGATION AND SAMPLING PROTOCOLS

Contents

B1 Soil Investigation and Sampling Protocol

Soil investigation and sampling will be completed through the advancement of window sample and cable percussion boreholes as described within this document. ENVIRONs Safe Working Methods for anticipated site activities are provided below.

Investigative locations have been chosen to provide a targeted assessment of key areas of the site, as well as providing general background conditions where appropriate.

The investigation will provide a 'snapshot' of soil conditions at the time of the investigation.

ENVIRON's field procedures for the logging of ground conditions and the field based headspace analysis of soil samples (for screening purposes only) are provided below.

B1a Safe Working Method – Cable Percussion Drilling

Safe Working Method #2

Borehole Investigation – Cable Percussion Technique

Task:

The excavation of boreholes up to approximately 20m deep, using a cable percussion drilling rig, owned, maintained and operated by technically competent contractors. All drilling works will be supervised by an ENVIRON UK member of staff.

EHS Hazards identified:

See Risk Assessment Document

Procedures:

1. Identify proposed locations and mark ground and location plan.
2. Clear locations using ENVIRON UK approved service tracing contractor in accordance with Siteworks procedure number 2.
3. Ensure locations are signed off.
4. Brief operator regarding working procedures.
5. Agree procedures as follows:
    a. arrange hand signals to stop and start operations;
    b. reinforce that no excavation is to be conducted unless supervised;
    c. agree where to stand to ensure that operator and supervisor can see each other;
    d. outline reinstatement requirements.
6. Using CAT & GENNY to scan location prior to excavation.
7. Agree with operator to begin and stop as required.
8. ENVIRON UK policy is that all contractors should wear personal protective equipment appropriate to the tasks they are undertaken. Where this does not happen ENVIRON UK site personnel should notify the HS Manager or HS Advisor.
9. Ensure operators are wearing PPE.
10. Never:
    a. approach the borehole excavation whilst the drilling is in operation
    b. operate the drilling rig
    c. attempt to sample soil arisings, unless the drilling operation is stopped and the drilling tools are located in a secure position
11. Ensure backfilling of excavation or well installation is supervised and that especially contaminated material is handled in accordance with the Duty of Care/Special Waste Regulations.
12. Ensure reinstatement leaves a sound and safe surface.
13. Where a strong odour is detected or some other unforeseen event occurs during excavation, all personnel will follow the Contingency Plan, Safe Working Method #7.

Personal Protective Equipment:

To be used

- Hi-vis jacket
- Hard hat
- Steel toe cap boots

- Gloves (for sampling and operatives)
- Ear defenders
- Goggles (during breaking-out of concrete surfaces/borehole drilling).
- Tyvek or similar disposable overalls (not hooded)

To be used initially and thereafter as considered appropriate by the SSP;

- Dust mask (Type 3M 8835 or better)

B1b BOREHOLE INVESTIGATION – Rotary Technique

SAFE WORKING METHOD #3

Task:

The excavation of boreholes up to approximately 20m deep, using a rotary drilling rig, owned, maintained and operated by technically competent contractors. All drilling works are to be supervised by an ENVIRON UK member of staff:

Hazards identified:

See Risk Assessment Document

Procedures:

1-8. As Widow Sampler excavation method.
9. Ensure operators are wearing PPE.
10. Never:

- approach the borehole excavation whilst the drilling is in operation
- operate the drilling rig
- attempt to sample soil arisings, unless the drilling operation is stopped and the drilling tools are located in a secure position

11. Ensure backfilling of excavation or well installation is supervised and that especially contaminated material is handled in accordance with the Duty of Care/Special Waste Regulations.
12. Ensure reinstatement leaves a sound and safe surface.
13. Where a strong odour is detected or some other unforeseen event occurs during excavation, all personnel will follow the Contingency Plan, Safe Working Method #7.

Personal Protective Equipment

To be used;

- Hi-vis jacket
- Hard hat
- Steel toe cap boots
- Gloves (for sampling and operatives)
- Ear defenders
- Goggles (during breaking-out of concrete surfaces/borehole drilling).
- Tyvek or similar disposable overalls (not hooded)
- To be used initially and thereafter as considered appropriate by the SSP; Dust mask (Type 3M 8835 or better)

B1c Safe Working Method #5

Window Sampling / Soil Vapour Survey

Task:

The investigation of sub-surface ground conditions using a hollow auger (window sampler) pneumatically-powered breaker and/or 'hilti' drill operated by technically competent operatives.

EHS Hazards identified:

See Risk Assessment Document

Procedures:

1. Identify proposed locations and mark ground and location plan.
2. Clear locations using ENVIRON UK approved service tracing contractor in accordance with Siteworks procedure number 2.
3. Ensure locations are signed off.
4. Brief operator regarding working procedures.
5. Agree procedures as follows:
    a. arrange hand signals to stop and start operations;
    b. reinforce that no excavation is to be conducted unless supervised;
    c. agree where to stand to ensure that operator and supervisor can see each other;
    d. outline reinstatement requirements.
6. Using CAT & GENNY to scan location prior to excavation.
7. Agree with operator to begin and stop as required.
8. ENVIRON UK policy is that all contractors should wear personal protective equipment appropriate to the tasks they are undertaken. Where this does not happen ENVIRON UK site personnel should notify the HS Manager or HS Advisor.
9. Ensure backfilling of excavation is supervised and that especially contaminated material is handled in accordance with Duty of Care Regulations.
10. Ensure reinstatement leaves a sound and safe surface.
11. Use hand-held spray/water mist on all excavated material if dust is excessive. If dust/odour is liberated during excavation stop work and evaluate:
    a. nature of dust
    b. possible targets
    c. use of further control measures (multi-point water spray, shifting location)
    d. discontinuing the excavation.
12. Where a strong odour is detected or some other unforeseen event occurs during excavation, all personnel will follow the Contingency Plan, Safe Working Method #7.

Personal Protective Equipment

To be used:

- Hi-vis jacket
- Hard hat
- Steel toe cap boots
- Gloves (for sampling and operatives)
- Ear defenders
- Goggles (during breakout of concrete surfaces/drilling activities/groundwater sampling
- and site designated areas)

- Tyvek or similar disposable overalls (not hooded)

To be used initially and thereafter as considered appropriate by the SSP:

- Dust mask (Type: 3M 8835 or better)

B1d Procedure - Soil Logging

Introduction

During a site investigation, the ground conditions (soil and rock) will be recorded to provide information on the condition of the soils and groundwater beneath the site. The current standard for recording naturally laid down soils and rock is BS5930, however this standard does not cover descriptions of man made or reworked materials and was written principally for engineering purposes.

Staff Responsibility

The project manager will ensure that all personnel are provided with this procedure prior to undertaking site work to ensure compliance with our procedures.

Recording Soil

Samples will be described as follows, and descriptions will be worded in the following order, as shown in Table 1 below.

Table 1 : Recording Soil

Soil Characteristic Description	
Density	Record density of soils (Loose – Dense – Very Dense for argillaceous (i.e. sandy) materials) or Soft – Firm - Stiff for cohesive (i.e. clayey) materials)
Moisture	Record water content of soils (Dry – Damp – Saturated)
Colour	Record colour of soils
Secondary Constituent	Record whether it is silty, sandy, clayey, gravelly etc prior to the primary constituent. NOTE: you cannot have a silty sandy clayey gravel, which would be a meaningless description.
Primary Constituent (ALL CAPS)	Record Primary constituent, i.e. SAND, CLAY, in upper case.
Tertiary or other Constituent	Record tertiary constituent, for instance silty CLAY with small pockets of soft grey clay or with much rootlets
Strata	If strata are known, put this in brackets at end of descriptions (i.e. LONDON CLAY) An example description would be: "Dense damp orange brown silty SAND with some fine to coarse gravel (1st RIVER TERRACE GRAVEL)

Recording Made Ground

Made Ground will be described by assessing the approx. percentage of the type of materials present, and particular note should be made to recording the additional constituents of these materials (see Section 10.6).

MADE GROUND – comprising loose dry black silty clay with much ash (25%), brick (5%), metal (1%), and wood (1%).

Recording Rock

Rock will be described as shown in Table 2 below.

Table 2 : Recording Rock

Colour	Is it light, dark, speckled blue grey, etc?
Grain Size	Fine to coarse, amorphous, vitreous?
Texture	Vesicular or porphyritic?
Fabric	Does it have bedding, lamination or foliation?
Structure	Is it jointed, faulted, any discontinuities? This will be hard to see from a borehole – check rock at surface
Weathering	Is the rock fresh (unweathered) or is it highly weathered (e.g. crumbles easily)?
Secondary / Minor	What are the secondary constituents – oolitic, micaceous, calcareous etc?
Rock Type	SANDSTONE/SCHIST/GRANITE
Strength	Very weak, weak, extremely strong etc?

Additional Environmental Observations

The following observations, as detailed in Table 3 below will also be made during logging.

Table 3: Environmental Observations

Colour	Pay particular attention to colour. If you are recording something as grey or black, ensure this is not contamination colouring. NOTE IF NATURAL OR NOT
Odour	Record any notable odours. DO NOT DIRECTLY SNIFF SAMPLE. This contravenes ENVIRON's H&S procedures, but do observe anything notable
% Composition	If you are recording fill it is important to note the approximate % of fill materials within the matrix, such as brick, wood, metal etc
Sheens etc	If you are recording a sheen or oily colouration, try to determine the source of this colouration (diesel, petrol, engine oil, tar etc)
Tarmac	Ensure to note the presence of tarmac or coal within a sample of made ground, as this will give an elevated PAH concentration within analysis
Voids/No Return	A void should be recorded where a drill bit jumps through a horizon, and NO RETURN should be recorded when the driller has been unable to obtain any arisings
Water	Always record the first seepage of water and the resting level after 20 minutes
Weather	Always note the time and weather during sampling. This has wider implications during data interpretation, even if it does not seem important at the time
PID	Always record PID reading for every 0.5m interval throughout the excavations/borehole

B1e Procedure - Soil Gas Headspace Testing

Introduction

Solvents, degreasing agents and petrol compounds are common industrial contaminants that potentially may be present on many industrial sites. This procedure outlines how ENVIRON headspace test soil samples in the field. This is a rapid screening method, which is useful for giving an indication of the presence of such volatile organic compounds in soils. It is not a substitute for laboratory chemical analysis; rather it can be used to help determine which samples should be analysed.

This procedure covers the field testing of soil samples during Phase II site investigations. The procedure involves the testing of soil gas headspace using either a Photo-ionisation Detector (PID) or Flame Ionisation Detector (FID).

Staff Responsibility

It is the responsibility of all site personnel to ensure that this field procedure is followed correctly and to communicate the findings each day with the project manager/director, to ensure the investigation objectives will be achieved, and that any alterations can be communicated with the Client and agreed.

Equipment

- A photoinisation detector (PID) or flame ionisation detector (FID), fully calibrated and charged.
- For an FID, a cylinder of hydrogen gas.
- A canister of calibration gas.
- A spare canister of calibration gas.
- Clean new plastic bags in which to put the soil samples.
- A marker pen to write on the plastic bags.

Office Procedure

Check that you have the right PID/FID. Check what kinds of volatile organic compounds may potentially be present on site in advance (i.e. during the desk-based research stage of a project). Some VOCs are capable of being detected by a range of PID and FID equipment, where as other VOCs may only be detected by one instrument.

ENVIRON UK has PIDs fitted with both 10.2ev lamps and 11.7eV lamps. The 11.7ev lamp is capable of detecting a wider range of VOCs, but it is also a lot more sensitive and less easy to use in the field.

Calibration

Check that the instrument you intend to use is calibrated properly and is fully charged.

Calibration involves checking the instrument's reading using a known concentration of calibration gas. If the instrument is not within calibration then you must recalibrate it before you leave the office. If the instrument will not calibrate you must not take it on site.

Headspace Testing Procedure

1. On arrival at site, check calibration of the PID – if calibration is out - re-calibrate.
2. Prior to undertaking any headspace reading, take two "blank readings" for QA/QC purposes as follows:

    - Take a background reading in air (not by the back of your running car!!) Note any sources of possible interference – e.g. if you are at a solvent factory!! or if there are cars/plant moving around/running;
    - Take a reading inside the empty sample bag/container. It is possible to get readings of 1-4ppmv (often higher in hotter weather) from polythene bags/tubs such as those supplied by ALcontrol Technichem. These background results can then be taken into consideration when taking your final reading;
    - Take a background reading after you have written the sample reference on the bag.

3. Where possible, try not to take all the sample from the target depth (Window Sampling only) for headspace if you intend to submit for VOC analysis. Always leave enough for analysis in-situ – the shaking of the bag releases VOCs and could render analytical results useless!
4. Ensure an airtight seal between the bag and the PID probe.
5. Be mindful not to place the probe too close to the sample to avoid blocking the probe with soil or getting contaminated residue on the end of the probe that may constitute a source of on-going interference. 10cm above the air/soil interface should suffice.
6. Shake the bag – if sample is clay, squeeze the clay a few times.
7. Leave PID in bag for at least 30 seconds. Record the peak concentration and also note if the reading stabilises at a lower concentration.
8. If you record a result that you consider significant (based on your specific site conditions), jar up immediately and place in a chilled cool box.
9. If you record an elevated result (e.g. >500ppmv), recalibrate the PID and purge the machine with air with the probe attached. Then obtain a background reading in air to ensure that the machine is purged and free of potential on-going sources of VOCs.

B2 Groundwater Investigation and Sampling Protocol

Groundwater will initially be investigated and monitored as part of the works described within this report.

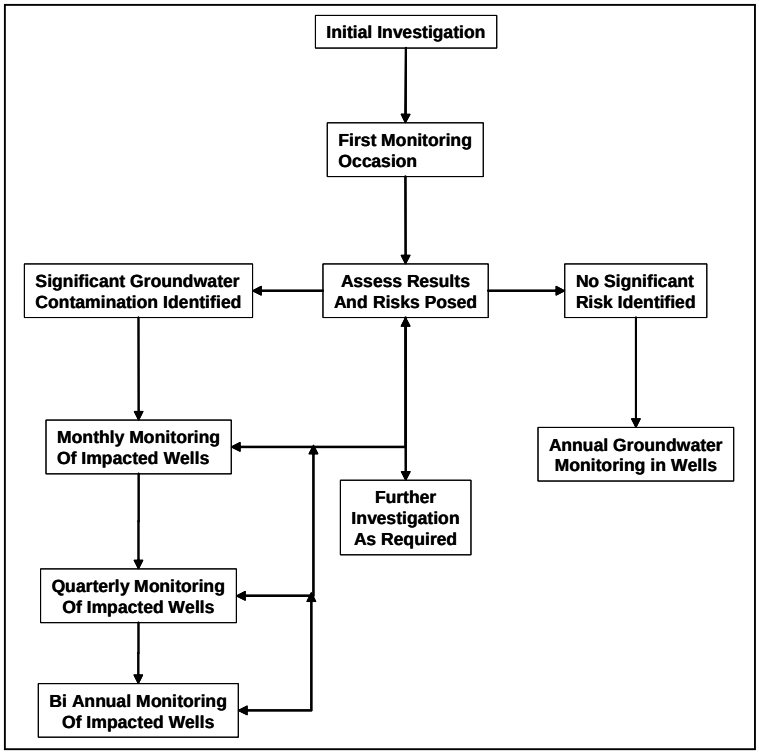
ENVIRONs field procedures for the Installation of Monitoring Wells and Groundwater Sampling are provided below.

Groundwater monitoring wells installed at the site will be re-monitored on an annual basis as per Section 4.3.

However, should any analysis results be deemed to be of environmental significance, this monitoring regime will be altered accordingly. In this event, it is anticipated that groundwater monitoring of wells containing significant contamination will be undertaken on a monthly basis in order to establish representative results. Should initial or monthly results indicate that it is appropriate, additional investigation may be undertaken.

Should monthly monitoring indicate that conditions are stable and do not represent an immediate risk to sensitive receptors, monitoring will be stepped back to quarterly for a period of 12 months, followed by bi annually for a further six months and finally annually.

This rationale is summarised in the flow diagram below.



In the event of an emergency incident, groundwater will be sampled immediately and the decision making regime as described above will be applied.

B2a PROCEDURE - INSTALLATION OF MONITORING WELLS

INTRODUCTION

Monitoring wells for gas and/or groundwater sampling can be installed in either boreholes or window sample wells. Prior to installing any well the following information MUST be obtained either from desk-based sources or throughout drilling. The well design MUST then be discussed with the project manager/director prior to installation, when this data can be interpreted in line with the purpose of the well and the investigation.

The following is the minimum information required for constructing a monitoring well:

- details of the geology (e.g. aquifer thickness, nature of strata etc.);
- information on perched groundwater and confining/low permeability layers;
- groundwater levels (both strike and rest levels – i.e. a period of time after water was first encountered. Also, keep an eye on water levels in previously drilled monitoring wells); and borehole depths.

STAFF RESPONSIBILITY

It is the responsibility of all site personnel to ensure this field procedure is followed correctly and to communicate the findings each day with the project manager/director, to ensure the investigation objectives will be achieved and that any alterations can be communicated with the Client and agreed.

MONITORING PURPOSE OF THE WELL

1. **GAS ONLY:** the well will only need to be installed into the unsaturated zone (aim to screen at least half the thickness of the unsaturated zone but do not compromise the bentonite seal (see bentonite), at the top of the well.

2. **GROUNDWATER ONLY:** the well should be screened in the saturated zone only. The top of the screen should be set below the water table and extend at least 3m below the groundwater strike (this applies to all types of groundwater monitoring wells).

3. **GROUNDWATER AND GAS:** the well will need to be installed into the saturated zone and also be screened in the unsaturated zone (again, screen half thickness of unsaturated zone).

NOTE: this is the most likely installation for most of our site investigation. Installation needs to take in to account likely seasonal or tidal fluctuations.

4. **FREE PHASE PRODUCT (LNAPL):** the well will need to be screened above the water table (aim for at least 1m, and ensure that the groundwater surface does not meet a join in the well screen).

5. **CHLORINATED SOLVENTS, TARS AND OTHER DNAPLS:** the well will need to be installed across the entire thickness of the aquifer, or into a low permeability horizon. If the aquifer is particularly thick (e.g. chalk) then a judgement will need to be made on site. Remember to dip the base of the well during monitoring.

If the well is to be installed in a major aquifer (e.g. chalk or Triassic sandstone), prior consultation with the Environment Agency may be necessary.

CONFINING LAYERS

Confining layers refer to any layer that may restrict the migration of contaminants (normally vertically) and potentially can be 'short circuited' by the installation of a monitoring well.

The following MUST be considered whilst designing a monitoring well:

1. perched water in the made ground should not be 'connected' by well screen or filter pack with the main groundwater body;
2. separate aquifers (e.g. gravel overlying chalk) should not be connected;
3. bentonite seals should be installed across the entire thickness of a 'barrier' (i.e. clay/silt layers or horizons of lower permeability than the surrounding strata) to prevent connecting water from above the barrier to that below;
4. barriers may be present at the base of a borehole and it may be necessary to install a bentonite seal at the bottom of a monitoring well; and
5. it is good practice to 'bentonite up' a borehole if a monitoring well is not installed, not backfill with arisings.

CONFLICTING OBJECTIVES

There is the likelihood that the objectives of the monitoring well will conflict with the above (e.g. monitoring for gas and groundwater where the water table is separated from the made ground by a 0.5m clay layer). If this is the case, then installing separate wells or using window sample wells for shallow monitoring should be considered. Another possibility is to install two monitoring wells in a borehole separated by a bentonite seal. However, it is preferable to drill a completely separate well (pairs) to guarantee a 'barrier' remains intact rather than installing two wells in one borehole dual).

GROUNDWATER FLUCTUATIONS

You will need to drill to a deeper depth if you need to use the wells in a long term monitoring programme (e.g. groundwater levels in the Chalk aquifer can fluctuated by 6m between winter and summer). In all cases the base of the monitoring well should be at least 3m below the water table (if geology allowing).

WELL INSTALLATION

The following questions should be answered prior to undertaking borehole drilling and installing the well:

1: What type of pipework should be used?
As a rule of thumb, the best materials to use (most chemically resistant etc.) are, in the following order:

- Stainless Steel,
- HDPE
- PVC.

Stainless steel is the most expensive and is very rarely used. Recently HDPE and PVC have become similar in price and, therefore, HDPE should be the preferred choice of material. However, PVC has an advantage in that a smaller slot size can be obtained (0.5mm) as opposed to a minimum of 2mm with HDPE. This is important depending on the geological formation (see also question 2: filter pack).

Generally, smaller slot sizes (0.5mm) should be used in fine, silty strata (e.g. alluvium, chalk) and larger slot size in coarser strata (e.g. gravels, coarse sand).

2: What type of filter pack should be used?

Generally, a preference should be made for 2-4mm gravel with 0.5mm slot size and 3-6mm gravel with 2mm slot size. Filter pack should be washed and inert (flint/quartz). The filter pack should be placed adjacent to the screen and preferably between 0.2m and 0.5m above the screen (to stop bentonite blocking the screen). Geotextile wraps can be used and are effective in very silty strata (e.g. some chalk formations), although it is generally better not to use geotextiles due to potential conflicts with chemicals/contaminants (i.e. releasing/sorbing onto the plastic materials).

One further aspect is that it may be necessary to 'protect' the filter pack from the seepage of some types of bentonite grout (see question 3: bentonite). This can be achieved by placing fine sand on top of the filter pack and also bentonite pellets (that sink) – this decision will need to be made based on site conditions. There are calculations that can be undertaken to design the most suitable filter pack grading for the surrounding strata, though these are normally used for abstraction wells rather than monitoring wells.

3: What should be used for sealing the well?

Typically, for a standard well, bentonite pellets are the best type to use. These should be poured down the borehole annulus and 'set' by tipping water down afterwards (see also question 5: headworks). Ideally, a 1m thickness of bentonite should be used to seal the top of the well (however, if there is a high water table and gas monitoring is required, this may not be possible, although a minimum GTM screen should always be installed). If the well is deeper (usually >15m) or a better seal is required (e.g. between different aquifers) it may be necessary to pump bentonite/cement grout (60:40, although other ratios can be used) into the borehole using a tremmie pipe. This will require mixing bentonite and cement at the surface. Where pumping grout is involved, it may be necessary to 'protect' the filter pack (see question 2: filter pack). The main purpose of adding bentonite is to separate and seal out surface water or any other perched/groundwater (on which information should have been obtained during the drilling).

Use a tape measure or dip meter to check depths of filter pack and bentonite in the borehole.

4: Does size matter?

For a standard site investigation, most groundwater monitoring wells should be 50mm diameter. However, it may be worth considering 100mm/150mm diameter if there is the likelihood that the wells may be used in a remediation system (e.g. product recovery that requires larger diameter pumps), or if more detailed hydrogeological testing is required. Window sample holes should be installed with 35mm diameter wells. Keep clear of 19mm diameter wells as they are too narrow to sample or obtain representative groundwater samples.

5: Well Headworks?

This is the last part of a drilling job and is consequently normally neglected as everyone (apart from dedicated ENVIRON employees) wants to go home. Unfortunately, this is the only part of the well that the client/site operators see. Purchase covers that are suitable for the setting (e.g. car parks etc) and set it in concrete (including the base). Make sure the bentonite has been 'set' by water (see bentonite) as this has a tendency to ooze up into the cover and occasionally push the covers up.

SHOULD THE WELL BE DEVELOPED?

Ideally yes. There are a number of techniques that can be used, but the easiest is probably over pumping the well (e.g. honda pump, air lift etc.). If this is not practical and the well is being sampled for the first time, an effort should be made to pump more than the standard three volumes for purging (a minimum of six would be useful and ten even better).

WELL DECOMMISSIONING

Prior to undertaking the works, it should be determined whether the wells should be decommissioned following the investigation works or if they are required for potential future monitoring. If the wells are to be decommissioned, a budget allowance should be made and timescale obtained from the client (i.e. divestiture of the site).

All wells should be decommissioned in accordance with Environment Agency guidance (www.environment-agency.gov.uk).

WELL SURVEYING

Water levels in the monitoring well need to be recorded accurately during groundwater monitoring (see Procedure 3). Each well should be surveyed to Ordnance or Site Datum prior to monitoring. Best practice is to survey the well after installation and to a notch cut into the top of the pipework. This will insure the most accurate results, as a few cm differences can dramatically affect groundwater flow interpretation.

Check with your project manager whether there is room in the budget for the site to be surveyed post installation (time and money will need to be set aside for ENVIRON personnel or a subcontractor to do this). If budget constraints exist, each well location should be surveyed at the time of service clearance and site personnel should accurately record any site variances (e.g. height of well cover above surveyed ground level) in this level and adjust the data accordingly.

B2b PROCEDURE - GROUNDWATER MONITORING

INTRODUCTION

This procedure provides basic guidance that should be adhered to when monitoring groundwater and taking samples. There are a number of considerations to be taken into account when monitoring a well which are often defined by site conditions e.g. seasonal or tidal fluctuations, interactions between groundwater bodies and preached groundwater, project objectives and budget. Procedure 2 should be referred to prior to installing the well.

STAFF RESPONSIBILITY

All site personnel who are undertaking groundwater monitoring should follow this procedure. The project manager should ensure all personnel are proficient in groundwater sampling and are familiar with these procedures.

SITE EQUIPMENT

You will need:

- Log Book
- Well Construction Details
- Borehole Keys
- Site / monitoring well location Plan
- Dip Meter
- Interface Probe (if required)
- Pump (See Groundwater Parameters Matrix, Section 5)
- Bailers (See Groundwater Parameters Matrix, Section 5)
- Decontamination Equipment
- Sampling Equipment (Bottles, Fixing Agents (if necessary) labels, chain of custody forms, icepacks)

WELL DEVELOPMENT

Each monitoring well should be developed following installation and prior to sampling. Development should not be undertaken within 12 hours of the well being installed, to allow time for the well grouting to cure (this may not be possible for all projects - check with project manager), and not sooner than three days prior to sampling.

Well development is NOT purging

Well development is the process whereby drilling fluid or added water (if used) and fine particles from the well and surrounding formation are removed, and the process 'stabilises' the filter (sand or gravel) pack and surrounding formation so that sand/silt free water can be obtained over the lifetime of the well.

Over-pumping is a common way to develop a well during routine investigations (note: other techniques are necessary for wells designated as abstraction wells). Over-pumping involves pumping the well at a rate above the range of normal in-service pumping rates until relatively sediment free water is obtained. Over-pumping should be undertaken for a minimum of one hour. This may not be

possible for most sites due to project constraints - however this demonstrates the need to which monitoring wells should be developed.

Development can also be achieved by pumping out groundwater from the well until parameters such as temperature and conductivity have stabilised by undertaking on-site field testing methods.

Shallow wells (<10m) can normally be developed using a suction-lift/submersible pump, which should be placed near the bottom of the well and periodically moved to agitate the water and enhance the removal of fine particles from the sand pack. Do not place the pump resting on the bottom of the well as often silts in the well block the pump.

VOLATILE SCREENING PROCEDURE

Prior to removing the well seal (bung or screw cap), ENVIRON personnel should monitor the presence of volatile organic compounds (or land gas monitoring, see Procedure 4) within the well airspace. The following procedure should be followed:

1. Prior to touching the well, record: date, time, weather, temperature, physical condition of well and any other relevant information.
2. IMMEDIATELY after removing well seal, monitor for presence of volatiles using PID (see Procedure 7, Soil Vapour Surveys). Record concentration on the ENVIRON groundwater log sheet.
3. Note any odours present in the well - DO NOT actively smell any gas/vapour from the well - this should only be if you happen to notice any odours.
4. Record depth to water and total depth of well measured from the surveyors notch on the casing - or if not available, to the level of the ground surface (with dip meter).

WELL PURGING

Ideally, groundwater samples should not be collected from new wells until at least three days after well development. However, due to project constraints, this may not be possible (check with the project manager). Monitoring wells should always be purged prior to sampling on each and every occasion. Purging involves the removal of 'stagnant' water that has been in contact with atmospheric gases and the well casing and screen materials. This contact can affect the water chemistry and oxygen can diffuse into the water and dissolved gases can volatilise or oxidise. Organics may be sorbed by the well casing and trace elements may be leached from the well casing. Purging will ensure a representative sample is obtained from the aquifer.

Purging Procedure

1. Dip Water Level and Well Depth and Measure Internal Well Diameter.
2. Calculate Well Volume (50mm well: 0.5m = 1L and 35mm well : 1m = 1L)
3. Remove 3 x well volume using either dedicated bailer or submersible pump positioned at the TOP of the water column (see Note 1).

(NOTE 1: If the water level is above the screened area and the pump intake is within the screened area, it is possible for a section of stagnant water to remain within the well. It is good practice, in such cases, to commence pumping at the top of the water table and slowly lower the pump during the purging process until the pump is within the screened section, when purging will be complete).

4. If the well purges dry, the water should be allowed to recover to 90% of the pre-purge water level (or for two hours, which ever occurs first) prior to sampling.
5. In the case of sampling from domestic, industrial or public supply wells where a pump is permanently fixed within the well, the well should be pumped long enough to flush any pipework. If well construction details are available, the well should be purged of three well volumes. If this information is not available, the well should be pumped for approx. 15minutes prior to sampling or until pH, temperature and specific conductivity stabilise. Care should be taken to adjust the pumping rate if necessary to avoid pumping the well dry (see Note 2).

(NOTE 2: Pumping a well dry would lead to aeration of the well, resulting in volatile loss or change in the chemical characteristics of the aquifer nearest to the well. This will prevent a representative sample being collected).

SAMPLE COLLECTION

Groundwater samples should be collected immediately on completion of purging, unless significant drawdown has occurred in which case the well should be allowed to recover. Sampling **MUST** be undertaken within **2 hours** of purging, to ensure a representative sample is obtained.

ENVIRON collects routine samples using a dedicated bailer, which can be either Teflon or polyethylene (or stainless steel). In some cases samples may be collected via the submersible pump but tubing **MUST** be dedicated to each well. These procedures should not be applied to the collection of samples for **VOLATILES**).

Sampling Procedure

The following procedure should be followed during sample collection (following purging):

1. Lower bailer into well using nylon cord. Nylon cord should be knotted or marked in meter lengths and the bailer should be lowered to the mid point of the screened well section. Care should be taken to minimise agitation and exposure to the atmosphere.
2. Dispose of water from the first two bailers.
3. When sampling for VOLATILES take from the THIRD bailer (ensure volatiles are placed in 60ml water vials with Teflon lid).
4. Sample for other determinants thereafter (ensure use of appropriate sample containers).
5. If LNAPL (e.g. fuel hydrocarbons) is being sampled, the bailer should only be lowered so that the top of the bailer is at the top of the product level. In this case, the first bailer full of water/product is withdrawn and sampled for product ID (See Note 3 below).
6. If DNAPL (e.g. chlorinated solvent) is being sampled, a 'grab sampler' should be used and placed at the base of the well (See Note 3 and 4 below).
7. Record date and time of sample collection, the collection method, parameters to be analysed, the number and type of sample containers and any other information that may be relevant to interpretation.

(NOTE 3: DO NOT SUBMIT THE GROUNDWATER SAMPLE FOR ANALYSIS FOR DISSOLVED HYDROCARBONS/SOLVENTS if free product has been identified. Representative samples cannot be obtained if NAPL is present. If it is known that NAPL is present in a well, these wells should be sampled after sampling has been completed on all other wells on the site. This will further reduce the potential for cross-contamination. It should be assumed that groundwater below the product will be at concentrations equal to solubility limits.

(NOTE 4: In some cases dissolved hydrocarbons/solvent concentrations will be required to determine the depth or thickness of the plume. These should only be monitored via specifically designed multilevel wells or samplers).

B3 Soil Gas and Vapour Investigation and Sampling Protocol

B3a PROCEDURE - LAND GAS MONITORING

INTRODUCTION

Land gas is produced as a result of the decomposition of organic materials such as peat, paper, vegetation, wood, etc. and is commonly associated with landfill sites. Land gas is usually monitored via well installations in boreholes or window sample holes (see Procedure 2 - well installations).

Instruments Available (Do not use unless you have completed an induction by trained personnel)

- LMSx (with internal flow meter)
- Analox GA94 (pods available for hydrogen sulphide and carbon monoxide) with GF60 gas flow meter

STAFF RESPONSIBILITY

It is the responsibility of all site personnel to ensure that this field procedure is followed correctly and to communicate the findings each day with the project manager/director, to ensure the investigation objectives will be achieved, and that any alterations can be communicated with the Client and agreed.

OFFICE PROCEDURE

- Check that the battery status of instrument is sufficient for the proposed monitoring, charge before leaving the office.
- Sufficient volume of calibration gas is available and calibrate in the office prior to leaving.
- Print off ENVIRON gas monitoring record sheet.

PROCEDURE (ANALOX WITH FLOW METER)

1. Calibrate instrument and record details in calibration book
2. Switch flow meter on and reset
3. Attach flow meter to borehole gas tap
4. Make sure flow meter is out of direct wind and shelter “inlet and outlet ports” if necessary, for example using bucket or instrument case
5. Open gas tap and start timer on flow meter
6. Leave running for 180 seconds and then stop timer
7. Record average flow (l/hour), total flow (ml), and differential borehole pressure (Dp) with tube still attached
8. Disconnect flow meter and close gas tap
9. Switch on Analox, attach to gas tap, and open gas tap
10. Record atmospheric pressure (mb)
11. Switch on the pump and record peak gas readings (often after about 30 seconds), which should include methane (%), carbon dioxide (%) and oxygen (%)
12. Disconnect Analox and leave running in clean air to clear readings, then switch off
13. Dip well using dip meter or oil/water interface probe - only after gas monitoring is complete
14. Close gas tap

PROCEDURE (LMSX WITH INTERNAL FLOW METER)

1. Calibrate instrument and record details in calibration book
2. Switch LMSx to flow meter screen
3. Attach flow meter tube to borehole gas tap
4. Make sure instrument is out of direct wind and shelter "inlet and outlet ports" if necessary
5. Open gas tap and press "tick for live flow" on flow meter
6. Leave running for approximately 180 seconds
7. When readings have steadied, press "cross to hold flow" and record average flow (l/hour), differential borehole pressure (Dp), and atmospheric pressure (mb) with tube still attached
8. Disconnect flow meter tube
9. Attach to gas concentration tube to gas tap
10. Switch to gas concentrations screen and switch on the pump and record peak gas readings (often after about 30-60 seconds, when readings have steadied). This should include methane (%), carbon dioxide (%) and oxygen (%)
11. Disconnect LMSx and leave running in clean air to clear readings, then switch off
12. Dip well using dip meter or oil/water interface probe- only after gas monitoring is complete
13. Close gas tap

All information should be recorded on an ENVIRON log sheet.

ATMOSPHERIC PRESSURE

Changes in atmospheric pressure have a direct effect on land gas concentrations, particularly on landfills. Low (<1000mb) and falling atmospheric pressure are more likely to result in gases within the ground being forced out into the atmosphere, and it is thus likely that the highest gas readings are monitored during these conditions.

Remember that atmospheric pressures can change throughout the day of monitoring, so it is important to record the changes throughout the day and make notes on the weather conditions on the day of monitoring. Where monitoring over a number of occasions is required, this should be undertaken during different atmospheric conditions (e.g. high and low). This can be planned in advance by consulting the weather forecasts.

B4 Surface Water Investigation and Sampling Protocol

Not required for the SPMP.

B5 Infrastructure Investigation and Sampling Protocol

The infrastructure investigation and sampling techniques that could be used by MECL include:

- Visual Inspection;
- Pressure tests of tanks and pipework;
- Leak testing of tanks and pipework;
- CCTV inspection of drains and sumps; and
- Ultrasonic testing of tanks and pipework.

Infrastructure structure investigations and sampling protocols to be used in order to conduct such techniques will be developed and provided to the EA prior to implementation. Visual inspection processes are described in *Section E2*.

APPENDIX C

ANALYTICAL PROTOCOLS AND LABORATORY ACCREDITATION

C1a Tables - Proposed analytical suite based on ASR zoning

See Table 3.1.1 a & b and 3.2 a & b within the SPMP.

C2 Analytical Techniques

Table C2-1 ALcontrol Technichem Groundwater

	Method	MDL	UKAS
Polynuclear Aromatic Hydrocarbons			
PAH screen	Total PAH by HPLC	1 µg/l	No
PAH screen	Total PAH by GCMS (sum of EPA16)	0.1 µg/l per cpd	Yes
PAH (19 speciated)	GC-MS (EPA16)	0.1 µg/l per cpd	Yes
Petroleum Hydrocarbons			
TPH (C8-C40)	GC-FID	0.1 mg/l	No
TPH with Basic Carbon Banding (C6-10, 10-30 & 30-40)	GC-FID and GC-MS	0.1 mg/l	No
TPH - RBCA Carbon Banding (C6-8, 8-10, 10-12, 12-16, 16-21, 21-36)	GC-FID and GC-MS	0.1 mg/l	No
TPH (TPHCWG)	TPH (C5-C35) with aliphatic /aromatic separation and banding based on TNRCC method 1006 inc BTEX/MTBE	0.01mg/l	No
TPH by IR	Infra-red based on USEPA 418.1	0.1 mg/l	Yes
Diesel Range Organics (C10 - C30)	GC-FID	0.1 mg/l	No
Petrol Range Organics (C6 - C10)	GC-MS (Headspace)	1 mg/l	Yes
BTEX by GC-MS	GC-MS (headspace) based on US EPA	0.001mg/l	Yes
Mineral oils (aliphatics)	GC-FID	0.1 mg/l	No
Mineral oils (banded C10-12,12-16,16-21,21-35)	GC-FID	0.01 mg/l	No
Mineral oils (aliphatics)	Total aliphatics by EZ flash	0.05 mg/l	No
Semi-Volatile Organic Compounds (SVOCs)			
SVOCs target list (one extraction only)	GC-MS Based on US EPA 8270	Various	Yes
SVOCs target list(single extraction) plus TICs (top 10 peaks)	GC-MS Based on US EPA 8270	Various	Yes (not TICs)
SVOC scan (up to 10 peaks,>80% fit)	GCMS library seach	Various	No
Volatile Organic Compounds (VOCs)			
VOCs target list only	GC-MS (headspace) based on US EPA 8260	Various	Yes
VOCs target list plus TICs (top 10 peaks)	GC-MS (headspace) based on US EPA 8260	Various	Yes (not TICs)

	Method	MDL	UKAS
Phenols			
Phenols (total)	Spectrophotometric analysis	0.02 mg/l	Yes
Phenols (monohydric)	Spectrophotometric analysis	0.02 mg/l	Yes
Phenols (total) by HPLC	HPLC	0.5 μg/l	Yes
Phenols (speciated)	HPLC	0.5 μg/l	Yes
Phenols (speciated)	GC-MS based on EPA 8040	0.001 mg/l	Yes
Organics - others			
Solvent Extractable Matter (SEM)	Cyclohexane extraction with gravimetric determination	4 mg/l	Yes
PCBs (ICES 7 congeners)	GC-MS	0.007 mg/l	Yes
Total Organic Carbon (TOC)	Combustion and infra-red	1 mg/l	Yes
Metals (Dissolved / Total)			
ICRCL suite - As,Cd,Cr,Cu,Ni,Zn,Pb,Zn,Hg,Se	ICP-OES	various	Yes
CLEA suite - As,Cd,Cr,Cu,Ni,Zn,Pb,Zn,Hg,V,Ba,Be	ICP-OES	various	Yes (V, Ba & Be pending)
Individual / Additional metals	ICP-OES	various	Pending
Hexavalent Chromium	Spectrophotometric analysis	0.03 mg/l	Yes
Inorganics			
Alkalinity	Titration	4 mg/l	Yes
Ammoniacal Nitrogen	Ion Selective Electrode	0.05 mg/l	Yes
BOD / BOD ATU	5 day	1 mg/l	Yes
COD	Hach	10 mg/l	Yes
Chloride	Ion chromatography	2 mg/l	Yes
Cyanide (Free)	Distillation / spectrophotometric	0.03 mg/l	Yes
Cyanide (Total)	Acid distillation /spectrophotometric	0.03 mg/l	Yes
Dissolved Oxygen	Meter	0.1 mg/l	Yes
Electrical Conductivity	Conductivity Meter	10 μS/cm	Yes
Fluoride	Ion Selective Electrode	0.01 mg/l	Yes
Hardness	Titration	10 mg/l	Yes
Nitrate	Ion chromatography	0.05 mg/l	Yes
Nitrite	Spectrophotometric	0.05 mg/l	Yes
pH	pH meter	0.1 pH units	Yes
Phosphate	Spectrophotometric	0.05 mg/l	No
Sulphate	Ion chromatography	2 mg/l	Yes
Sulphide	Ion Selective Electrode	0.05 mg/l	Yes
Thiocyanate	Spectrophotometric	0.03 mg/l	Yes
Total Suspended Solids	Gravimetric	10 mg/l	Yes
Total Dissolved Solids	Gravimetric	5 mg/l	Yes
Dissolved Methane	GC-FID	0.001 mg/l	No

Table C2-2 ALcontrol Technichem Soils

	Method	MDL	UKAS
Polynuclear Aromatic Hydrocarbons			
PAH screen	Total PAH by HPLC	10 mg/kg	No
PAH (16)	GC-MS (total of USEPA 16)	0.1 mg/kg	Yes
PAH (19 speciated)	GC-MS (LPH - 19)	0.1 mg/kg per cpd	Yes
PAH (16 speciated)	GC-MS Based on EPA 8100	0.1 mg/kg per cpd	Yes
Petroleum Hydrocarbons			
TPH (C8-C40)	By GC-FID	5 mg/kg	No
TPH - Basic Carbon Banding (C6-10, 10-30 & 30-40)	By GC-FID and GC-MS	10 mg/kg	No
TPH - RBCA Carbon Banding (C6-8, 8-10, 10-12, 12-16, 16-21, 21-36)	By GC-FID and GC-MS	10 mg/kg	No
TPH (TPHCWG) *	TPH (C5-C35) with aliphatic /aromatic separation and banding based on TNRCC method 1006 inc BTEX/MTBE	0.1mg/kg	No
TPH by IR	Infra-red based on USEPA 418.1	10 mg/kg	Yes
Diesel Range Organics (C10 - C30)	GC-FID	5 mg/kg	No
Petrol Range Organics (C6 - C10)	GC-MS (Headspace)	1 mg/kg	Yes
BTEX + MTBE by GC-MS	GC-MS (headspace) based on US EPA 8150	0.001mg/kg	Yes
Mineral oils (aliphatics)	GC-FID	5 mg/kg	No
Mineral oils (banded C10-12,12-16,16-21,21-35)	GC-FID	5 mg/kg	No
Semi-Volatile Organic Compounds (SVOCs)			
SVOCs target list (one extraction only)	GC-MS Based on US EPA 8270	Various	Yes
SVOCs target list (single extraction) plus TICs (top ten peaks to 1mg/kg only)	GC-MS Based on US EPA 8270	Various	Yes
Volatile Organic Compounds (VOCs)			
VOCs target list only	GC-MS (headspace) based on US EPA 8260	Various	Yes
VOCs target list plus TICs (top 10 peaks to 0.01mg/kg only)	GC-MS (headspace) based on US EPA 8260	Various	Yes
Phenols			
Phenols (total)	Spectrophotometric analysis	1 mg/kg	No
Phenols (monohydric)	Spectrophotometric analysis	3 mg/kg	Yes
Total Phenols by HPLC	HPLC (methanol/water extraction)	0.02 mg/kg	Yes
Phenols (speciated)	HPLC (methanol/water extraction)	0.02 mg/kg	Yes
Phenols (speciated)	GC-MS based on EPA 8040	0.001mg/kg	Yes
Organics - others			
Solvent Extractable Matter	Toluene extraction with gravimetric determination	500 mg/kg	Yes
PCBs (ICES 7 congeners)	GC-MS	0.005 mg/kg per cpd	Yes
Organic Content - BS 1377	Titration	0.10%	Yes

	Method	MDL	UKAS
Organic Content - Loss on Ignition	Based on SPH version 2.6	0.10%	Yes
Calorific Value	In house method	200 J/g	No
Metals			
ICRCL suite - As,Cd,Cr,Cu,Ni,Zn,Pb,Zn,Hg,Se	ICP-OES / Aqua Regia Digest	Various	Yes
Water Soluble Boron	ICP-OES - hot water extraction	0.5 mg/kg	Yes
Hexavalent Chromium	HCl extraction, ICP measurement	5 mg/kg	Yes
CLEA suite - As,Cd,Cr,Cu,Ni,Zn,Pb,Zn,Hg,V,Ba,Be	ICP-OES	Various	Yes (V, Ba & Be pending)
Individual / Additional metals	ICP-OES	Various	Pending
Inorganics			
Ammoniacal Nitrogen	Distillation and titrimetry - based on LPH ver 2.6	10 mg/kg	Yes
Carbonate Content	Acid treatment and titration	10 mg/kg	no
Chloride (water soluble)	Ion Chromatography	10 mg/kg	Yes
Chloride (acid soluble)	Titration	200 mg/kg	Yes
Cyanide (Free)	Spectrophotometric analysis	5 mg/kg	Yes
Cyanide (Total)	Acid distillation /spectrophotometric	5 mg/kg	Yes
Electrical Conductivity	Conductivity Meter	10 μS/cm	Yes
Fluoride (water soluble)	Ion Selective Electrode	1 mg/kg	Yes
Nitrate (water soluble)	Ion Chromatography	10 mg/kg	Yes
Nitrite	Spectrophotometric analysis	1 mg/kg	No
pH	pH meter	0.1 pH units	Yes
Extractable Phosphate	Spectrophotometric analysis	5 mg/kg	No
Sulphate (water soluble)	Ion Chromatography	0.01 g/l	Yes
Sulphate (Acid Soluble)	ICP-OES	200 mg/kg	Yes
Sulphide – Acid Soluble	Ion Selective Electrode	10 mg/kg	Yes
Sulphur (Elemental)	HPLC	100 mg/kg	Yes
Sulphur (Total, Acid Soluble)	ICP-OES / Aqua Regia Digest	0.01%	Yes
Thiocyanate	Spectrophotometric analysis	5 mg/kg	Yes
MISCELLANEOUS			
Leachate Prep - NRA	10:1 extraction	NA	Yes
Asbestos screen	Visual screen of soil sample	ND	No
Asbestos Identification	Polarised Light Microscopy	Type	Yes
Asbestos % w/w	Gravimetric then Calculation	0.001%	N/A
Cement Content	Various	N/A	No
Ferric/ferrous iron	Colorimetric Determination	20 mg/kg	No
High Alumina Cement		ND	No
Loss on ignition	Gravimetric Determination	0.10%	Yes
Whole Oil Fingerprint			

APPENDIX D

QUALITY ASSURANCE AND QUALITY CONTROL

Contents

This will be provided to the EA with specific QA/QC data when the reference data is collected.

APPENDIX E

INSPECTION AND MONITORING PROTOCOLS

Contents

E2 Infrastructure Monitoring Protocols

INFRASTRUCTURE MONITORING PROCEDURE

Visual Inspection For Leaks, Spills and General Condition

1. Procedure

1.1. Primary Containment (Drums/IBC's/Above surface pipework)

1. Tour site and check all areas of use and storage.
2. In particular check risk areas (outfall to river, unprotected soil and drains)
3. Check containers for leaks, general condition (i.e cracks and potential leaks), lid intact, label present etc.
4. Check where the container has been located and can it be on a bund.
5. At all times seek to consolidate usage areas, minimise stock and provide bunds for these areas.
6. Check presence of spill kits.
7. Where action is required complete details on monitoring record including action required and persons responsible.

1.2. Secondary Containment (Bunded containers)

1. Tour site and check all areas of use and storage.
2. In particular check risk areas (outfall to river, unprotected soil and drains)
3. Check containers for leaks, general condition (i.e cracks and potential leaks), lid intact, label present etc.
4. Check bund condition including cracks and whether the bund would be effective if spillage occurred.
5. Check if bund is empty.
6. Check presence of spill kits.
7. Where action is required complete details on monitoring record including action required and persons responsible.

1.3. Tertiary Containment

1. Tour site and check roadways, kerbs, standing areas, storage areas and material handling areas.
2. In particular check risk areas (outfall to river, unprotected soil and drains).
3. Check for any signs of damage or potential for transfer of potential pollutants to subsoil, trade effluent or rainwater gullies.
4. Where action is required complete details on monitoring record including action required and persons responsible.

2. Frequency

1. Primary, Secondary and Tertiary Containment areas are to be checked on a regular basis.
2. Reports will be reviewed at the environmental review meetings.
3. Corrective action will be assessed at the environmental review meeting.

3. Subsurface Structures

1. Remove inspection covers and inspect prior to treatment.
2. Check for presence of sedimentation build up.
3. Following treatment (sediment removal and jetting) check for cracks or signs of damage.
4. Where action is required complete details on monitoring record including action required and persons responsible.

3. 1. Frequency

1. Subsurface structures will be inspected on a regular basis.
2. Reports will be reviewed at the corresponding daily operations meeting.
3. Corrective action will be assessed at the senior management review meeting.
4. Subsurface structures will be further checked using CCTV in the event that visual inspections deem this to be necessary.

4. Emergencies

5. Should a routine inspection reveal a loss of containment which could result in an emission to trade effluent, soil or outfall to river immediate action must be taken.
6. The following personnel must be informed immediately: -
    a. Dean Thomas (Manufacturing Systems Manager).
    b. Geoff Macklen (Works Engineer).
    c. Ian Stimson (Operations Manager).
    d. David Parr (General Manager).
    e. The Environment Agency. 08708506506
    f. Water Company (Welsh Water) Tel. No. 0800 052 0130

7. Dean Thomas will act as site coordinator to deal with the situation.
8. Deputies for dealing with a situation of this nature are: -
    a. Geoff Macklen (Works Engineer).

INFRASTRUCTURE MONITORING – MECL SWANSEA

Visual Inspection For Leaks, Spills and General Condition (Page 1 of 2)

Date of inspection		Inspector	

Area	Type and Location	Acceptable (Y or N) If not please describe findings.	Action By	Completion Date	Completion (Sign-off)
Subsurface Structures	1.				
	2.				
	3.				
	4.				
Primary Containment	**Drums**				
	1.				
	2.				
	3.				
	4.				
	5.				
	6.				
	7.				
	8.				
	9.				
	10.				
	IBCs				
	1.				
	2.				
	3.				

INFRASTRUCTURE MONITORING – MECL SWANSEA

Visual Inspection For Leaks, Spills and General Condition (Page 2 of 2)

Area	Type and Location	Acceptable (Y or N)	Action By	Completion Date	Signed
	Above Ground Pipework				
	1.				
	2.				
	3.				
Secondary Containment	**Permanent Bunding**				
	1.				
	2.				
	Chemical Storage Area				
	1. Various facilities				
Tertiary Containment	**Roadways**				
	1.				
	2.				
	3.				
	Waste Skip Storage Areas				
	1.				
	2.				
	Material Handling areas				
	1.				
	Other Hard Standing Areas				
	1.				

E3 Data Recording and Reporting Procedures
(Not required for E1, E2 addressed above in above section)

APPENDIX F

OTHER ISSUES
(No Issues)